TRANSCRIPT OF PROCEEDINGS BEFORE THE
STATE OFFICE OF ADMINISTRATIVE HEARINGS
(TEXAS COMMISSION ON ENVIRONMENTAL QUALITY)
AUSTIN, TEXAS

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| APPLICATION OF TEXCOM GULF DISPOSAL, LLC, FOR TEXAS COMMISSION ON ENVIRONMENTAL QUALITY COMMISSION UNDERGROUND INJECTION CONTROL PERMIT NOS. WDW410, WDW411, WDW412 AND WDW413) | SOAH DOCKET NO. 582-07-2673 TCEQ DOCKET NO. 2007-0204-WDW |
| APPLICATION OF TEXCOM GULF DISPOSAL, LLC, FOR TEXAS COMMISSION ON ENVIRONMENTAL QUALITY COMMISSION INDUSTRIAL SOLID WASTE PERMIT NO. 87758 | SOAH DOCKET NO. 582-07-2674 TCEQ DOCKET NO. 2007-0362-IHW |

HEARING ON THE MERITS
MONDAY, DECEMBER 17, 2007

BE IT REMEMBERED THAT at 9:01 a.m., on Monday, the 17th day of December 2007, the above-entitled matter came on for hearing at the State Office of Administrative Hearings, William P. Clements, Jr., Building, 300 West 15th Street, Room 407D, Austin, Texas before THOMAS WALSTON AND CATHERINE EGAN, Administrative Law Judges, and the following proceedings were reported by Lou Ray, a Certified Shorthand Reporter of:

Volume 4 Pages 850 - 1153

PROCEEDINGS
MONDAY, DECEMBER 17, 2007
(9:01 a.m.)
(TexCom Exhibit No. 72 marked)
JUDGE WALSTON: We'll go on the record. It's Monday, December 17th, 2007, and this is a resumption of the hearing on the merits in SOAH Docket Nos. 582-07-2673 and 2674, the Application of TexCom Gulf Disposal, L.L.C., for underground injection control permits and for an industrial solid waste permit.

Just for the record, the location has been changed. We're now holding a hearing at the SOAH hearing facilities in Austin, Texas.

Are there any preliminary matters that we need to take up?

MR. RILEY: No, Your Honor.

JUDGE WALSTON: Okay.

MR. WALKER: Your Honor, there is a preliminary matter. The applicant has provided us --

MR. RILEY: I'm sorry, Mr. Walker, I'm having trouble hearing you.

JUDGE WALSTON: Yeah, you can stay seated, and you really need to talk in the microphones in this room. It's hard to hear.



MR. WALKER: The applicant this morning, Your Honor, has provided additional disclosures, which if I understand correctly, would be information that has been reviewed by Dr. Langhus. Is that right, Mr. Riley?

MR. RILEY: No, it's actually information that Dr. Langhus compiled yesterday.

MR. WALKER: This information has been provided to us this morning, Your Honor, which obviously Dr. Collier, who is about to testify, has not had an opportunity to review yet.

It is a substantial bit of information that the applicant is, I presume, intending to cross-examine Dr. Collier with this morning based upon their expert's review of the information. And, of course, it is information, as I understand, that -- I suspect the applicant will say was essentially part of that information that we disclosed to them the day after Dr. Collier's -- or at the time of his deposition and then provided copies the day after his deposition, which I believe was the 6th of December.

It places Dr. Collier in a position of essentially today having to review and prepare information that Dr. Langhus has asserted this morning, and I think that places Dr. Collier at a



disadvantage.

MR. RILEY: Well, it was intended to place Dr. Collier at a disadvantage, so I'm glad we accomplished that goal. What it is, is a review of Dr. Collier's work done by Dr. Langhus and the back-up material that Dr. Collier cited. So it's nothing more than what Dr. Collier has offered to this body in his prefiled testimony, looking at the back-up documents that he purports support his diagrams and maps and a digest of each one of those segments.

And it will all become clear -- this is cross-examination material and it was composed just yesterday by Mr. Lee and Dr. Langhus going through each one of the purported faults that Dr. Collier has placed on a map and put into evidence as Aligned Protestant 1P. And the intention is to go through with Dr. Collier each one of his lines on that map, and that's the nature of cross-examination.

So I'm not sure how Dr. Collier is disadvantaged if indeed he was accurate in putting together his exhibit. Then he should have no difficulty at all citing to the source material we'll ask him about.

JUDGE WALSTON: Well, why don't we proceed, and if it's something that Dr. Collier says,



"I need some time to review this," then we may take a break and let him review it. But we'll proceed and see how it goes.

MR. WALKER: I will point out that on the face of the disclosure, Your Honor, there is a reference that Dr. Langhus has reviewed or prepared the attached documents in anticipation of his testimony. That's an erroneous assertion. This information was not prepared by Dr. Langhus in anticipation of his testimony. He's already testified.

MR. RILEY: It's in anticipation of his rebuttal testimony. If that's a clarification you need, Mr. Walker, then we can certainly make it here on the record.

MR. WALKER: All right. Thank you, Your Honor.

JUDGE WALSTON: Anything else on a preliminary matter?

MR. WALKER: Nothing else.

JUDGE WALSTON: Okay. If Dr. Collier will step up to the witness stand?

Will you raise your right hand?

(Witness sworn)

JUDGE WALSTON: Be seated, and state

your full name for the record.
WITNESS COLLIER: Hughbert Arnold Collier.
JUDGE WALSTON: Dr. Collier, you're doing a good job. Keep it up trying to talk directly into the microphone if you can there. They're not very good unless you're almost right on top of it.
WITNESS COLLIER: All right.
MR. WALKER: May I proceed, Your Honor?
JUDGE WALSTON: Yes.

PRESENTATION ON BEHALF OF THE ALIGNED PROTESTANTS

HUGHBERT A. COLLIER,

having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. WALKER:

Q Dr. Collier, have you been retained in this contested hearing to provide expert testimony?
A Yes, I have.
Q And are you a doctor of philosophy in the discipline of hydrogeology?
A Yes.
Q Have you given pre-filed testimony in this cause?
A Yes.



Q At this time, Dr. Collier, do you have any corrections to your prefiled testimony?
A Yes.
Q On Page 28, Line 3 --
MR. RILEY: Could we have a minute while we get to that page?
I'm there. Thank you.
JUDGE WALSTON: Okay.
A It should state "compilation of faults identified in public records and Geomap structure maps and drafted by."
Q Anything else on that page, Dr. Collier?
A Line 11 should state "through 1-M and the maps from Geomap Company."
Q All right. Anything else on that page?
A Line 12 should state, "Is this document a true and correct compilation of the public records and Geomap Company information?"
Q All right.
A Line 16 --
MR. RILEY: I'm sorry, the witness is correcting a question. Is that -- instead of correcting an answer, he was correcting a question he was asked.
JUDGE WALSTON: I guess so.



MR. RILEY: I guess the answer to question would be "no," if it's not complete?
WITNESS COLLIER: Well, no, my answer stays the same because all throughout this Geomap maps are public record. You know, they're available to the public, if you purchase them.
MR. RILEY: So then you don't need to change that answer?
WITNESS COLLIER: I guess not.
MR. RILEY: Okay.
Q (By Mr. Walker) Anything else on Page 28, Dr. Collier?
A That's everything on Page 28.
Q Was there a correction on Page 5?
A On Page 28, Line 16 --
Q I'm sorry.
A -- "compilation of faults identified in public records and by Geomap Company."
Q Okay. Is there a correction on Page 5?
A Yes. Page 5, Line 9 and 10, it should read, "I have given depositions eight times or more and one of these at the Railroad Commission."
JUDGE WALSTON: Say that again now.
WITNESS COLLIER: The phrase "at the Texas Railroad Commission" should be after "I have



given depositions eight times or more, one of these at the Railroad Commission."
Q (By Mr. Walker) Dr. Collier, any other corrections to your testimony?
A On Exhibit 1P in the legend -- I believe it's the last item identified in the legend.
JUDGE EGAN: Is it 1P or 1T?
WITNESS COLLIER: "P" as in Paul.
JUDGE EGAN: Okay. Thank you.
A I think it presently states, "The completion data and water map from January 1st, 1944," and the source is from the Texas Railroad Commission files. So that's in the legend, the bottom line of the legend, just add to the last line "from the Texas Railroad Commission files."
Q (By Mr. Walker) Dr. Collier, any other corrections to your testimony?
A None.
Q With those corrections, Dr. Collier, do you adopt your prefiled testimony and the accompanying exhibits as if you were testifying in person?
A I do.
MR. WALKER: At this time, Your Honor, the Aligned Protestants would offer into evidence the prefiled testimony of Dr. Hughbert Collier as Exhibit

1, additionally Exhibits 1A, through 1Q; and then additionally Exhibits 1R through 1V, as in Victor. And those exhibits, 1R through 1V, are the exhibits sealed under the protective order. Let the record please reflect that these exhibits are being tendered to the court reporter, two copies of each, as well as the testimony.

MR. RILEY: And while that's being done, I just have a procedural question, I suppose. When I cross-examine on the matters that are subject to the protective order and under seal in the record, how would like me to handle that? Would you like me to -- I don't know that the protective order requires us to do anything regarding the folks in attendance, and they're -- I guess they're not under -- they're not necessarily subject to the protective order, so I'm asking for clarification on how you would like me to handle that, Judges?

JUDGE WALSTON: When you get to a point we're going to go into a matter that's contained in the exhibits that are sealed -- you'll have to refresh my memory what the protective order states. I assume we would need to exclude people who are not covered by the protective order from the room.

MR. RILEY: That's typically what's



done. I don't know if that's necessary in this case since the information is provided by the Aligned Protestants, Montgomery County and City of Conroe. I don't know if that's something they would require. Typically, when it's business confidential information in these hearings, it is necessary to actually clear the room of folks who are not subject to the protective order. So I will leave it to those -- to the Intervenors to explain how they would like to handle it.

MR. WALKER: In response to that, Your Honor, the protective order states that the release of the materials is prohibited to anyone who is not a party to the litigation or representative of a party, a consultant or expert witness working with or retained by a party, or a TCEQ Commissioner, judge, or other individual who may be called upon to evaluate TexCom's applications that are subject to these proceedings.

So I suppose, if I can summarize that, parties, experts, TCEQ representatives, a representative of a party, those would be admissible individuals to hear the -- or to be present. Anyone else would apparently need to be excused.

JUDGE WALSTON: When we get to that,



bring it up and we'll see if there is someone who is not covered by the protective order in attendance and we'll excuse those persons.

MS. GOSS: Your Honor?

JUDGE WALSTON: Yes.

MS. GOSS: The ED needs some clarification on these exhibits. We have a Bates numbers AP-220, 223, 224 and 227, and could you let us know which ones of those are 1R, et cetera?

MR. WALKER: I'm confused by that numbering. I'm not certain --

JUDGE WALSTON: Are those part of the confidential exhibits?

MS. GOSS: Yes, he just -- pardon me. Mr. Walker just got 1R through 1V admitted, and I'm trying to determine which are which.

JUDGE WALSTON: Okay.

MR. WALKER: R, S and T, for the record, are the P2 Solutions; Exhibits U and V are the Geomap exhibits.

JUDGE EGAN: R, S and T are what?

MR. WALKER: R, S and T are the exhibits from P2 Solutions --

JUDGE EGAN: Okay.

MR. WALKER: -- U and V are from Geomap



Company.

JUDGE EGAN: Okay.

JUDGE WALSTON: And refresh my memory, were there any objections to the testimony of Dr. Collier that were made or sustained?

MR. WALKER: None that were sustained, Your Honor.

JUDGE WALSTON: I didn't think there were.

Okay. Then objections have previously been ruled upon and Aligned Protestants Exhibits 1, 1A through 1Q and 1R through 1V are admitted. And we'll just note for the record that 1R through V are sealed.

(AP Exhibit Nos. 1 and 1A through 1V admitted)

MR. WALKER: Thank you, Your Honor. With that, the Aligned Protestants will pass the witness for cross-examination.

JUDGE WALSTON: Okay. Lone Star?

MR. HILL: No questions.

JUDGE WALSTON: Individual Protestants?

MR. FORSBERG: No questions, Your Honor.

JUDGE WALSTON: Public Interest Counsel?

MS. COLLINS: No questions.

JUDGE WALSTON: Okay. Applicant?

MR. RILEY: I do have some questions, yes.

CROSS-EXAMINATION

BY MR. RILEY:

Q Good morning, Dr. Collier.

A Good morning.

Q Are you able to hear me from where you're seated?

A Yes.

Q All right. I'll try to keep my voice up. I'm having a little trouble with my voice this morning, but I will try to speak into the microphone so that we can proceed with this examination. If you have any trouble hearing me, please let me know and I'll try to speak up even louder.

Firstly, Dr. Collier, I want to be certain that I understood our discussion during your deposition about your prior experience with injection wells and injection disposal wells. And it's my understanding that you have looked at only one -- prior to the review of the TexCom permit application, you had only reviewed one Class II Railroad Commission application in any depth. Is that correct?

A Correct.

Q So you're -- the sum total of your experience



in disposal well review or review of applications for disposal wells, either at the Railroad Commission or the TCEQ is one application that you reviewed for a matter before the Railroad Commission?

A Correct.

Q And again, that was a Class II well. Is that correct?

A Correct.

Q Is it fair to conclude then that you have never reviewed an application to the TCEQ for a Class I disposal well?

A Correct.

Q What portions of the TexCom application did you review as part of your engagement by Montgomery County and the City of Conroe and in preparation for your testimony here this morning?

A My testimony -- my review and examination concentrated on Section 5, Section 7 and Section 8.

Q Did you review any other portions of the application?

A I read through some of it.

Q Can you be more specific, sir?

A I read through the application, but my review -- the work that I did was in Sections 5, 7 and 8.



Q Okay. Did you read through the entire application and all the exchanges with the TCEQ, the correspondence typically referred to as the notice of deficiency response?

A Yes.

Q If I understand your testimony correctly, you are not qualified to give opinions or to conduct reservoir modeling. Is that correct?

A Correct.

Q Is it fair to say, Doctor, that your testimony concentrated -- excuse me, your preparation and your testimony concentrated on identifying additional artificial penetrations in the area of review around the proposed TexCom facility, and additional faults in the area of review as you saw them?

A That was a major part of what I looked at.

Q Tell me all the parts of your review and what you did.

A In addition to those two parts, I reviewed all of the Section 5, which includes the local and regional hydrogeology and geology; looked at the parts of the application that require the applicant to inventory all wells, including water wells, within the area of review and then within a one-mile radius of



the property. I looked at the parameters that were used in the reservoir modeling.

Q What parameters did you look at regarding the reservoir modeling?

A I looked at the porosity, the permeability, the -- the aerial extent that the model is based on.

Q I'm sorry, I didn't understand the last portion of your answer. You looked at the aerial extent --

A The aerial extent.

Q Of what?

A That the model is based on. The model is based on some aerial extent geographic area.

Q Have you ever run a reservoir model?

A No.

Q Okay. And how did you review the reservoir modeling without having prior knowledge of reservoir modeling or being able to conduct reservoir modeling?

A Well, the applicant is required to list in the application all that -- the parameters that are input into the model. Those parameters are geological parameters that are based upon the study that was done or not done in Section 5, which is the geology. So you have to do the geology first in order to have the proper parameters to run in the model.

Q And what parameters, if any, do you have difficulty with or do you disagree with that were input into the reservoir modeling?
A The aerial extent for the model not having any -- aerial extent for no boundaries, and then the permeability from the Fall-off test is different from the permeability that was the core analysis that was used in the model.
Q All right. Let's talk about the last part of your answer. First you have a disagreement with the permeability that was used in the TexCom modeling. Am I understanding you correctly?
A Correct.
Q And why is that, sir?
A Well, they used 500 millidarcies in the model, and the Fall-off test gives a calculation of -- I think it was 81 -- 80-someting millidarcies.
Q Have you ever conducted a Fall-off test, sir?
A No.
Q Do you know what it involves?
A Yeah, I know what it involves.
Q What does it involve?
A It involves injecting at some rate -- I think they injected at, I believe, it was three barrels-per-minute, and injecting -- pressuring up an



interval for a time and then measuring the pressure as it declines over a period of time after you conclude injecting.
Q Have you ever interpreted or reviewed Fall-off data tests or data from a Fall-off test prior to this case?
A No.
Q Were you able to review the test data for the Fall-off test that you're referring to?
A I did not.
Q Where did you -- how did you then identify a difference in permeability as between the model inputs and what you believe was the Fall-off test result?
A It's mentioned in the records.
Q In the application, is it not, sir?
A Yes.
Q Do you understand the zone that was perforated in the original well WDW-315 and how many feet of perforation were done in that test?
A Yes.
Q And what was the -- what was the number of feet in WW -- WDW-315 for the Fall-off test?
A It was a little over 100 feet.
Q Does 90 sound correct, sir?
A It may -- it may be.



Q Other than regurgitating what's in the application already regarding the Fall-off test, do you have any ability to interpret Fall-off test data?
A No.
Q And you mentioned a core analysis that's also in the permit application. Do you know what a core analysis is?
A Yes.
Q What is it, sir?
A It's a sample of the formation that is removed during the drilling process, submitted to a lab, and then various petrophysical parameters are measured on it.
Q Would one of those petrophysical parameters measured include permeability?
A Yes.
Q Were the core samples from the WDW-315 evaluated in a laboratory?
A Yes.
Q And what were the results of those tests regarding permeability?
A I believe the permeability was listed as approximately 500 millidarcies.
Q Is it actually true, sir, that it's listed in a range?



A It may well be.
Q Okay. Do you know what the range is, sir?
A No.
Q How much time did you spend reviewing the core sampling data in the TexCom application?
A Not a lot of time.
Q Do you know where the core sample was taken in terms of the wellbore and the perforated interval that is -- was evaluated in the Fall-off test?
A I don't know the exact depth.
Q Do you know where it is in relationship to the perforated interval that was tested in the Fall-off test?
A Not without going back and looking to see the exact depth.
Q And yet you disagree with the use of that -- let's assume you're correct that it's approximately 500 millidarcies -- you disagree with using that permeability in reservoir modeling. Is that correct?
A Well, that value can be used, but when you have additional data such as a Fall-off test, it's what's called a matter of scale. And you have to look and decide -- if you have a discrepancy -- which of the two are more representative. And you see in the application they obviously believe that the zone that

they had perforated is too tight for production because the application states that they're going to abandon that zone and move up the wellbore and perforate an upper interval.

Q What did you mean when you said "too tight for production"? I don't understand that term.

A Well, too tight for injection.

Q Well, the -- do you understand that the TexCom application proposes to perforate different intervals within the injection zone?

A Yes.

Q All right. So tell me your understanding of the relevance of the Fall-off test given that knowledge, that TexCom believes that there are more permeable sands available in the well than were originally perforated?

A Well, the reservoir modeling that had been done to present has to be based upon data that's available.

Q And what are you basing that statement on, sir?

A If you're going to -- the reservoir modeling includes porosity, permeability. Since you have a Fall-off test, that's the data that you have at the time to input into the model.



Q Well, what statement -- you've never handled a Class II Well application, correct?

A Correct.

Q And you've never performed reservoir modeling, you've never reviewed Fall-off test data, and yet you're stating under oath on the record that you must use that Fall-off test data in this application. Is that your testimony?

A Yes, because what I have done is a lot of core analysis and integration of core analysis with a wireline log, with pumping tests, with reservoir characterization. And it's the same principles for that work that it is in this case.

Q What is "that work" that you -- you so vaguely refer to "that work," what work are you referring to?

A Any type of work in which you have core analysis, in which you have wireline logs, in which you have aquifer tests and you integrate the data to characterize the reservoir. And I've done those type of projects in Florida and in Texas in various aquifers -- reservoirs in Texas and other states as well. So the principles are all the same whether it's a Class I injection well, a Class II injection well, or whether it's just what we call reservoir or aquifer



characterization.

Q Well, I understand that's your -- I guess your statement of qualification to make such a statement of what is required in this case, but I'm trying to understand since you've never -- other than the one occasion you've already testified about regarding a Class II well at the Railroad Commission -- you've never done this work for injection wells. Is that correct?

A Correct.

Q Do you understand the regulatory process following permitting of an injection well?

A Somewhat.

Q All right. Do you understand that if indeed the Fall-off test originally done is correct and the permeability of the new interval perforated by TexCom is 81 millidarcies, that additional considerations are required before waste could ever be injected?

A Correct.

Q So if indeed you are correct -- although obviously the application believes otherwise, or applicant believes otherwise -- that the permeability is 81 millidarcies, then the TCEQ would require the applicant to make additional considerations before any waste could be injected. Do you understand that?



A Correct.

Q What is you're opinion as to the permeability of the lower Cockfield sands?

A It is low permeability.

Q You're going to have to be more specific, sir. What in millidarcies or darcies is the permeability of the lower Cockfield sand?

A Well, you can't put an exact number on it. You look at the logs. You see that the sands are thin -- relatively thin. There's a lot of shale interbedded with them. So, you know, is it 80 millidarcies? If it's going to have some variation without some type of analysis such as additional core analysis, or additional type of pressure testing, you can't put an exact number on it. But the applicant in the application --

Q That's not my question, sir. I asked you -- and I object to you giving an answer other than what I'm asking you, and I'd ask that the Judges instruct you to confine your answer to the question.

A Well, I am confining my answer to the question --

Q I asked you if you had an opinion as to the permeability of the lower Cockfield?

A Yes. And the applicant in the application

talks about the low permeability of the sand. There are no numbers that are given, but due to the depositional nature of the sand, it's recognized and you can see that -- I see that in the data -- that the permeabilities are low. Exactly how low, I can't -- I can't give you an exact number. But obviously the applicant thinks they're low enough that they're not going to inject into those sands.

Q Well, do you understand what -- what interval the application or the applicant proposes to inject into?

A Yes.

Q And what is that?

A They were -- they want to move up and reperforate about -- I think it's some 6,040 roughly to about 6180.

Q Does that correlate with a geologic stratum?

A Yes.

Q What is it?

A That's still fairly low in the Cockfield. And the applicant in their application talk about that --

Q I asked you does it correlate to a geologic stratum in your opinion?

A The 60 -- 6040 to 6180 is the lower part of



the middle Cockfield.

Q Is that your understanding?

A That's from the applicant's Page 73, figure Roman Numeral V.b1.3 --

Q And so --

A It's -- yeah, that's right.

Q So your understanding of the proposed injection interval in the application is the lower part of the middle Cockfield?

A They originally were putting it in the lower Cockfield, and then they mention that they're going to have to go ahead and move up higher, which would be the lower part of the middle Cockfield. The original interval is the lower Cockfield.

Q Do you not understand, sir, that they're moving up within the lower Cockfield higher than the original perforated zone, but not above the shale later between the lower and the middle Cockfield? Do you not understand that?

A That's not what I read in the application.

Q Do you not understand that, sir?

A Apparently I don't.

Q How thick is the lower Cockfield, sir?

A The lower Cockfield is identified by the applicant as being 100 -- about 110 feet thick.



Q Correct me if I'm wrong, Dr. Collier, the upper Cockfield runs from a depth of 5134 to 5629. Is that correct or incorrect?

A That's correct.

Q And the middle Cockfield runs from a depth of 5629 to 6045. Is that correct or incorrect?

A Well, on the exhibit that I'm looking at, they're identifying the top of the lower Cockfield as 6291. There may have been a later revision of this.

Q I don't know what you're looking at, sir.

A This is the applicant's figure V.b.1.3, dated 8-1-05.

Q And what is your testimony then regarding the thickness and the depth of the middle Cockfield?

A Well, I'm going off what the applicant --

Q Do you have a separate opinion other than what's in the application, Dr. Collier?

A No, not as to the top of the lower Cockfield.

Q So you're reading from the applicant's -- your interpretation of the application. Is that correct?

A No, it's not my interpretation from the application.

Q Okay. You've referenced one exhibit in the application. Do you know what it is you're



referencing?

A I've told you what it is twice.

Q You've told me the letter. Do you know what it is?

A It is the Cockfield formation in WDW-315 well illustrated with open hole wireline logs.

Q Are there other boring logs in the application?

A Yes, they have copies of their logs.

Q And do you have -- have you reviewed those other logs?

A I don't have them here before me.

Q That's not my question, sir. You said you reviewed the application. My question is did you review those borrowing logs before your testimony here this morning?

A I have looked at those logs.

Q Have you reviewed them sufficiently to offer an opinion as to the depth of the various stratum thereof concerned in this proceeding?

A I accept the applicant's designations.

Q So if the applicant designated the middle Cockfield of a depth of 5629 to 6045, you have no basis to disagree with that designation?

A I have no problem with that.

Q And you have no problem, I assume then, with the application's designation of the lower Cockfield as 6045 to 6390?
A No.
Q Can you tell me the -- starting from the surface -- the various stratum that underlie the proposed TexCom site?
A Yes.
Q If you're referring to something, please let us know what you're referring to.
A I'll refer to the -- the applicant has a strat column on Page V-18, and I accept their stratigraphic column. They call it a hydrologic strat column for the TexCom WDW-315 well.
Q Could you read, starting from the surface, the various stratum that underlie the TexCom site?
JUDGE WALSTON: Let me ask you: Is this one of the exhibits attached to your testimony as well?
WITNESS COLLIER: No.
JUDGE WALSTON: No.
WITNESS COLLIER: This is in the application. This is Figure V.b.2.1.
MR. RILEY: Would it be helpful if we identified that figure in the applications and then



point you to a page?
JUDGE EGAN: Thank you.
MR. RILEY: Thank you.
WITNESS COLLIER: In the original application of 8-1-05 this is Page 78 of 314.
MR. WILLIAMS: Do you know what volume?
MS. GOSS: Do you have volume numbers?
WITNESS COLLIER: I'm working on it. This is Volume 1.
MR. RILEY: The volume number -- at least I believe what the witness may be looking at -- is Volume 2 --
WITNESS COLLIER: Your application has Volume 1.
MR. RILEY: So these are exhibits, but if you have a copy of the exhibit and you can focus us more narrowly, I'd appreciate that. Is it a volume that is an exhibit in the case or is it a volume --
WITNESS COLLIER: It's your application.
JUDGE EGAN: It appears to be Volume 2 in our volumes. They've been marked differently from the exhibits.
WITNESS COLLIER: Mine is marked as Volume 1.
JUDGE EGAN: And it is Section -- under



Section 5 --
WITNESS COLLIER: Yes.
JUDGE EGAN: -- Page 78 of 315 --
MR. RILEY: That's what we have as ours also.
WITNESS COLLIER: Yes, that's right.
JUDGE EGAN: I believe it's exhibit --
MR. RILEY: That's correct.
Q (By Mr. Riley) Doctor, this particular hydrologic strat column does not go all the way down to the Cockfield shale. Is that correct?
A Correct.
Q Are you able to tell me the stratum that underlie the TexCom site all the way down to the Cockfield shale?
A Yes. You start on Page 78. I accept their designations on Page 78. And then if you back up a couple of pages, on Page 74 they show then the Jackson formation underlying the Catahoula down to 5180, and then the Cockfield formation from 5180 on down to the lower confining zone of the Cockfield.
Q All right. And you have no reason to disagree with those characterizations in the application or the identification of the stratum in the application?



A No.
Q I'd like to show you what has been previously marked as TexCom Exhibit 72, and perhaps that will be easier to work with for this series of question.
Dr. Collier, could you take a minute and review Exhibit 72 and compare it to the pages that you just pointed us to in the application and make sure that the stratum are listed in the correct order and properly under the -- as they are on this exhibit, Exhibit 72?
A (No response)
Q Again, all I'm asking for, Doctor, is in relative location, not anything beyond -- I'm not asking you to agree with or verify anything other than the order of stratum below the site?
A I agree.
Q Okay. And have you had sufficient time to review it and compare it to the application that you just adopted?
A Yes.
Q So am I correct in saying that at least as it pertains to the order of the stratum below the proposed TexCom site, Exhibit 72 is accurate?
A Correct.
MR. RILEY: At this time I offer into

the record TexCom Exhibit 72.
JUDGE WALSTON: Any objection?
Hearing none, TexCom Exhibit 72 is admitted.
(TexCom Exhibit No. 72 admitted)
Q (By Mr. Riley) Doctor, I think this will be easier to work with than the application in the binder, so let's look at Exhibit 72 together. And the question I have of you is would -- what is a horizon? When one is talking in geologic terms and is looking at a horizon, what would one be describing?
A Well, I think most people would be talking about a formation. It would be an identifiable unit in the subsurface that has unique enough characteristics to be separated from the strata above it and below it.
Q All right. And is it fair to say then, at least in what seems to be accepted geologic terms, that each of these various stratum are -- fit that qualification, they are different horizons?
A That would be -- that's more a layman's term. That would be fine.
Q Now, when one talks about mapping a horizon, what is one discussing in your understanding?
A Well, mapping a horizon, you're -- you're



mapping identifiable characteristic. Usually it is based upon wireline logs. So it could be a radioactive marker. It could be some other distinguishing characteristic, and you're preparing a subsurface map based upon that identifying characteristic.
Q And is that a -- well, let me ask you a different question: Are most wells when they're drilled cored and evaluated by a geologist?
A No.
Q Why is that?
A In the old days, they did. Nowadays relatively few wells are cored, mainly because of expense.
Q Am I correct then in understanding wirelines and other types of marker evaluations are not done by evaluating -- by evaluating a core sample?
A If they're available, they would be integrated with it. But since they're usually not available, then wireline logs are -- the correlations are made without cores, correct.
Q Okay. So a wireline -- what is a wireline? Can you be more descriptive?
A It's called wireline logs or you could just call it logging. It's -- they are different tools



that are lowered into a borehole on a wireline to either measure naturally-occurring physical properties of the subsurface, or to induce various either electrical current or radioactive elements to measure the physical properties.
Q Am I correct then what a wireline is doing -- or someone who is engaged in using a wireline tool -- is trying to evaluate the stratum in a wellbore?
A Correct.
Q As between wireline data and actual core samples, which would you consider more reliable for depicting the stratum in a particular wellbore?
A Well, the absolute ground truth is core.
Q I understand your answer to be that a core sample would be more reliable than a wireline evaluation?
A For -- yes, for that particular interval that the core is taken, yes.
Q So for that well. I'm not talking more generally than that. For that well, if you're doing a wireline versus evaluating a core, as a geologist I assume you'd rather have the core data itself?
A Well, your question mixes up -- if you continuously cored the well or whatever interval you're in -- let's say in this case your injection --



if you continuously cored it, that is the absolute best data. If you only have one or two selected cores out of it, then your best data, as far as characterizing the well, as you've said, or the interval, that best data is going to be the wireline log.
Q Okay. And I didn't mean to be misleading. I'm assuming in a hypothetical sense that when I've drilled a well, I've cored from the surface all the way down to the bottom or the total depth of the well and I have that core available. As between a core such as the one I just described and a wireline, am I correct that the core data is more reliable?
A Yes.
Q What other types of data or tools are used to evaluate the geologic stratum in a wellbore?
A Well, sometimes you look at the cuttings of the well -- from the well --
Q If you could explain what a cutting is so we all understand?
A Well, as you're drilling the well, what you're drilling through has to be removed from the well. And those samples, which are called cuttings, are brought up to the surface and you can study them. You can look at various types of pressure testing,

drill stem-test, any type of pressure testing of your formation will give you some information about your zone that you're studying.

Q Now, in trying to get a picture of what the stratum are as one drills through them, we've already discussed coring and wire logs, using -- excuse me, a wireline -- using a wireline, am I looking for something as a marker in the wellbore that gives me a -- I guess a point of depth? Do you understand my question?

A Well, you're looking at that plus a lot of other things. You're measuring physical properties of the rock as you raise that tool from the bottom up to the top. It's a continuous measurement of these various physical properties.

Q And what I'm trying to understand, Doctor -- let's -- you used the term radioactive marker, and what is a radioactive marker?

A Well, it's a -- it's a zone that has a high enough radioactive signature, and if it is consistent across an area, then it can be used as a marker and you can map based on it.

Q Let me see if I understand. If I took a hypothetical field and I did a number of different well borings and I found at a certain depth -- or



approximately the same depth -- a radioactive marker of the type you described. What I -- and I correlated those between and among the wells that I have drilled, then I'd be at least postulating that that's a point in geologic history that is common to those wells. Am I following along?

A Yes.

Q So I would map that in the sense of I -- if it appeared deeper in one well than another well, I could at least make some assumptions as to what the stratum was like as between those wells. Am I making sense?

A Correct.

Q All right. And just for clarification, let's say I find a radioactive marker in one well at 100 feet deep, just to make it simple, and in another well I find that radioactive marker that I believe are the same geologic event or correlates to the same geologic event that deposited the radioactive material, and I find that at 200 feet, what does that tell me, if anything, as between those two wells?

A If it is the same radioactive marker, it means that there has been movement in the -- it means that there is very probably been fault between those two wells.



Q Could it mean that the surface was uneven at the time the radioactive marker was deposited?

A You could have that.

Q So if I had a hill -- let's say in geologic time I had a hill that was a 25-foot hill -- or variation; let's not call it a hill -- a variation in a surface stratum or at the surface, and then whatever event occurs that deposits a radiologic marker, and then a couple million or whatever number, tens of millions of years pass, could that hill or high point on the surface show up as a different depth, then in the hypothetical I was trying to construct -- say there was a 25-foot difference between where I found the radiological marker in one well and radiological marker in another well, could that just be a variation in surface topography at the time of deposition?

A Could be.

Q Without any further information, how would you distinguish that variation in the radioactive surface marker as between a variation at the time of deposition or a variation because of movement or faulting?

A You could look at the lithology above and below your radioactive marker. And if you've got a difference like that -- say a hill -- then chances are



your fill material in your lower area might well be different than the other one. So you would look at the -- you would look at the log above and below your radioactive marker to get an indication of that.

Q Okay. But is there a definitive way to determine whether it was an undulation in the surface at the time of deposition or it was a fault that occurred at some subsequent time?

A You could perhaps use seismic to determine whether or not it's a fault.

Q All right. The extent of offset -- do you know what I mean when I use the term "offset"?

A Yes.

Q And what does that mean?

A If you take a fault plain and if you look at a -- the same point, the same horizon, on each side of the fault, the offset is how much vertical offset -- or it could be lateral offset -- it's how much that fault plane has moved. And generally it's a matter of up or down.

Q And how does one, based on wireline logs or anything other than a core sample, determine as between two wells that something -- or radioactive marker that shows no offset or zero foot offset -- how does that indicate a fault, in your opinion?

A If it has zero?
Q Yes, sir.
A If you have zero offset, then you would not be able to identify it on your wireline logs.
Q Why would one conclude that a zero offset is a fault if -- based on wireline information? How would that happen?
A They would have had to have had some other information such as pressure information and fluid levels.
Q Can you classify faults into major and minor categories?
A That's -- that's not done in the application. It's not done in TCEQ rules. And geologically -- I mean, there's -- you know, I guess theoretically you can do anything. It's not done in the application and it's not done especially in the TCEQ rules.
Q Sir, are you an expert in the TCEQ rules?
A I can read them.
Q I understand that. Have you ever handled a Class I permit application previously?
A No.
Q So is it fair to say that other than reading them, you have no experience in the requirements of the TCEQ rules, do you?



A Correct.
Q So let's stick to geology and your field of expertise. Do you -- or are you, as a geoscientist, able to distinguish between major and minor faults?
A It depends upon whose definition -- you have to define what you mean by "major" and a "minor" fault.
Q I'm asking you if you have ever in your career distinguished between major and minor faults?
A Yes.
Q All right. And what criteria did you use, sir?
A It depends upon the project and the scale.
Q Okay. Let's talk about the most recent project you worked on and that you were asked to identify major and minor faults. Can you recall that?
A No, because generally, if we're looking for faults, we're looking for faults. We don't classify them as major or minor because in hydrogeology --
Q Sir, I'm asking you if you recall that. That's all I asked you.
A No.
Q All right. You said that you've done it previously?
A Yes.



Q On what occasion?
A We've looked at faulting in the Floridan aquifer.
Q Okay. So in Florida you've looked at faulting and you have used some criteria to distinguish in that matter between major and minor, correct?
A No. I said we looked at faulting. We did not bother to distinguish between major and minor.
Q Sir, I've asked you several times now and I'm going to try to hone in now, and I'd ask you, unless my question calls for something more than a "yes" or "no" I'd ask you to confine your answer to a "yes" or "no."
Yes or no, you have in your prior work classified faults as major and minor?
A Perhaps at some time. I don't recall any specific --
Q A moment ago I asked you if you had ever in your work been called to classify faults as major and minor and you said yes. Now I'm asking to you recall those instances so we can establish some criteria and you say you don't recall them. Is that correct?
A I don't recall an instance.
Q Do you think it is possible and would be



useful in some situations to distinguish between major and minor faults?
A In some situations.
Q In what situations would you consider it to be helpful to make that -- to distinguish major and minor faults?
A Well, if you're doing large scale regional work, you're looking at fault trends that go across counties or maybe go across for hundreds of miles, then you're looking at what people would normally call major faults. And then when you go out and -- that would be stuff you'd look at like on maybe aerial photography or long seismic lines.
And then when you went out on a field work, you might find minor faults that are associated with those major fault zones. And those, depending upon the scale, may be -- you may see evidence in the field of anything from faulting down on a matter of a couple of inches up to feet or hundreds of feet, and major and minor would be relative depending upon the project.
Q Okay. Let's talk about relative major and minor faulting. Is a fault that's a hundred -- has 150 -- 100 to 150 feet of throw or offset, would you consider that to be a major fault?

A It depends upon your context. I would say, it would be a major fault.
Q And a fault that has, maybe, 20 feet of offset, would you consider that to be a major or a minor fault?
A Again, it depends upon your context and what you're classifying your fault for. There are cases where it could be still a major fault.
Q Okay. In this case, in the evaluation of Exxon data, are you able to distinguish any categories of faulting as between -- in the line that we've been discussing between major and minor?
A No, there's no need to.
Q I understand your position on rules you've only read once, sir, but I'm asking you if you can give us, as a geoscientist or a geologist, any ability to distinguish faults in this case?
A Distinguish faults as far as major or minor?
Q Yes, sir.
A No.
Q Then it's your opinion that all faults in this case are a necessary consideration. Is that correct?
A Yes.
Q And so even if there's a line drawn by some



geologist at some time that shows 20 feet of offset in a different horizon other than where the applicant is proposing to inject, you still think that is necessary for consideration?
A Yes.
Q Okay. Now, in your prefiled testimony you photograph a number of events that you purport are indications of surface faulting. Is that correct?
A Correct.
Q Which of those surface faults, as you've characterized them, are in the area of review?
A There is one of them.
Q Which one?
A That's the Big Barn, a portion of the Big Barn fault.
Q A portion of the Big Barn fault. Do you have your prefiled testimony before you?
A Yes. We can refer to exhibit -- my Exhibit O.
Q Your exhibit -- why don't we give everyone a chance to get there.
A O.
Q Now, I see on Exhibit O several circles that you've drawn around the proposed wells for TexCom which give a little variation in the area of review.



I assume those circles are drawn on a 2.5 mile radius. Is that correct?
A Yes.
Q And are the surface faults that you identify in your prefiled testimony, as you just said, only one of those faults, the Big Barn East Fault -- or a portion of the Big Barn East Fault is in the area of review, correct?
A Correct.
Q Why did you include the others?
A Because one of the things that the applicant is charged with is you're not --
Q Again, sir, I'm going to ask you, unless you have some other experience in what TCEQ requires, for you to explain the indication -- area of review, what does that mean to you?
A The area of review is a two-and-a-half mile radius for each of the proposed injection wells.
Q Yet many of the surface faults that you say exist, based on cracks in pavement and what-not are outside the area of review, correct?
A Yes.
Q And why did you include them?
A I started to explain that before you interrupted me. We looked at what -- the area both



within the area of review and outside of the area of review to get the regional context. And as it's stated in the rules, you're not limited to looking at the area of review if you think it necessary.
Q If you think it necessary, sir?
A Yes.
Q If who thinks it's necessary?
A Well, if the applicant -- it's stated if it's necessary to look beyond the area of review. And what you see -- the reason I did was because you're in a part of Texas where surface faulting is known to occur. It's common knowledge within the geologic community.
So we looked at both within the area of review and outside of it. Part of the area of review we could not drive some of the roads because they're part of the Conroe field and they were not -- dirt roads and not accessible to the public. Part of these roads are not paved, so we drove both inside and outside to get a feel and to see if there were even surface faults visible in the area.
Q Sir, are you saying there aren't many roads around Conroe and the proposed facility?
A That's not what I said.
Q Okay. What did you say?

A I'll repeat what I said to you.
Q I didn't ask you to repeat it. I asked you -- sir -- sir --
JUDGE WALSTON: Well, don't argue. I mean, he answered the question and he's trying to answer it again.
MR. RILEY: Okay. Well, let me rephrase. Thank you.
Q (By Mr. Riley) What roads did you drive in the area of review?
A We drove most of the paved roads within the area of review. But as I said, some of the roads are not paved. It doesn't do any good to look for surface faulting on unpaved roads. They don't show up. And then some of these roads, either paved or unpaved, were private roads within the Conroe field and we did not have access to them. So we did not drive those roads.
Q So when I asked you what roads did you drive, your answer seems to go beyond my question, so I'm going to ask you again. If you could confine your answers to the scope of my question -- you'll have an opportunity if Mr. Walker decides to ask you questions as follow up. Can we agree on that from this point forward?



A Yes.
Q Thank you. Could you find in your -- I believe it's Exhibit C -- the photograph that relates to the Big Barn East Fault? It's a series of photographs. It doesn't seem to have an independent page number.
A It would be the fourth page under Exhibit C.
Q All right.
A At the top -- the upper-most photograph.
Q Has this Big Barn East Fault been named or recognized in any publication, any geologic paper, anything other than your testimony in this case?
A No publications that I know of.
Q So the only place where the Big Barn East Fault exists is in this photograph and your testimony, correct?
A No.
Q Well, please explain.
A There are some geologists in the Houston area who specialize in surface faulting, identification and delineation of surface faulting.
Q But that's not you, is it, sir?
A That's right.
Q Sir, is there any publication by any of those geologists that indicate that the Big Barn Fault



exists and to what extent it exists?
A I answered that previously.
Q And the answer is no?
A No.
Q Okay. Other than your contact with a single other geologist -- is that correct? You've had one contact with a geologist that you employed to assist you in this case, correct?
A That's incorrect.
Q All right. Please explain.
A There were two geologists.
Q Okay. One of the geologists that you reference in your deposition you actually retained to identify surface faults for you in the Conroe area, correct?
A Correct.
Q And what is that geologist's name?
A That's Carl Newman (sic).
Q Excuse me?
JUDGE WALSTON: He couldn't hear you.
A Carl Newman (sic)
Q And as I understand it, you subcontracted with Carl Newman (sic) to get his information regarding his research -- not your research -- his research of surface faults in the area of review,



correct?
A That's only partially correct.
Q Did you ask Carl Newman (sic) for his research regarding faults in the area of review?
A Yes.
Q And the only fault that Carl Newman gave you was the Big Barn East Fault. Is that your testimony?
A No.
Q In the area of review, sir?
A Within the area of review, yes. But he did not give that to me. That's where your question is misleading. He would not give me his data. We went out and looked. He would not give me his maps, so we went out and drove the roads and did all the work again.
Q So -- and as I understand your testimony in your deposition, Mr. Newman has specialized in -- or is much more knowledgeable of the region around Houston and the region around the proposed TexCom site than you are personally, correct?
A Yes.
Q And he would not give you the information he has regarding his evaluation of surface faulting?
A He would not -- no, that's why we went out and looked at everything again.

Q So he gave you tips as to where to look. Is that correct?
A Correct.
Q And you identified the Big Barn East Fault. Is that correct?
A Correct.
Q Is that the way Mr. -- or Dr. Newman, I assume -- referred to it?
A Yes.
Q How did you define the extent of the Big Barn East Fault?
A Well, the Big Barn East Fault is really seen just where it cuts the highway there.
Q So on your map though it seems that you certainly have drawn a line much greater than I'd say, what, 20 feet through the roadway?
A Yes.
Q How did you determine the extent of the Big Barn East Fault?
A We did that for purpose of identification.
Q So one should not look at your Exhibit O and concluded that that fault actually is shown in the area of the review. Is that correct?
A No, it's in the area of review when you look at the circles.



Q Well, that's what I'm asking. You said that you only could tell the extent of the fault based on the surface cracks in the road, correct?
A Yes.
Q And the surface cracks in the road -- let me find the Big Barn East again. Is that Exhibit O that you were looking at earlier?
A Yes.
Q What's the scale of this map? I don't see it?
A It's bottom right-hand corner above the bar scale.
Q Okay. The -- it seems as though about half-inch equals half a mile, correct?
A Yes.
Q All right. How long would you say you've drawn the line for the Big Barn East Fault?
A It's drawn as a half-mile or longer.
Q But I though I just understood you to say that you could only determine the extent of the Big Barn East Fault by the cracks in the payment that you show in your picture and no further information exists?
A Yes.
Q So it would seem that the extent of the Big



Barn East Fault is 20 feet as best you can tell?
A Yes.
Q So the line that you've drawn on here is not representative of the extent of the fault and may indeed not be even inside the area of review, correct?
A It may not be, but it may be much longer than what we've drawn.
Q Okay. But we're going to go with what you know, sir, not what you think --
A Yes.
Q Based on your information and your evaluation of the Big Barn East Fault, the best you could say is it extends 20 feet across the roadway and is evidenced by the cracks that you show in your photograph?
A Yes.
Q Would that be true if I went through each of the other faults on this map -- your surface faults -- would it be true that the lines are not representative of the actual extent of faulting or are drawn to -- are not drawn to scale. Is that correct?
A Correct.
Q Let's talk about the depth of these surface faults. I believe you told me in your deposition that in your professional geologic opinion, these faults extend from the surface of the ground down thousands



of feet into the Willcox formation. Is that your opinion?
A Correct.
Q On what do you base that opinion, sir?
A I base it upon the fact that when you look at other mapping that has been done in the field, you see faulting at approximately 500 feet below the surface. You see faulting in the lower part of the Jackson formation at about 5,000 feet. You see faulting at different intervals within the Cockfield, and then you see deeper faulting on some regional maps. And when you talk to the geologists who specialize in identifying surface faults, if they're working a new area --
Q I'm going to object --
A I'm answering the question --
MR. RILEY: I'm going to object -- no, I'm going to object because now you're about to testify about what some other geologist who specializes. That's not you. Is that correct?
A That's correct.
JUDGE WALSTON: I think your question, though, was what does he base it on, and he is testifying that's what --
MR. RILEY: That's fair enough, Judge.

Thank you.
JUDGE WALSTON: It's not for the truth of the matter, but --
MR. RILEY: I understand.
JUDGE WALSTON: Go ahead.
A These geologists who specialize in surface faulting, if they're working an area they have not worked before, one of the first things they will do is to go to some of these -- any subsurface maps they have available, even though they're on much deeper horizons, and they'll look and see if there's any faulting identified on the maps. And then they know at about what angle the faults normally are. So you can do your trigonometry, and if you're at, say, 8,000 feet below the surface and you know the fault is maybe 45 to, say, 60 degrees or so, you can project where you would see it at the surface.
So one of their standard methods of operation, one of the things they do, is to project that deep fault to the surface, and then they go and look and see if they can find that fault on the surface. And quite -- not all the time, but quite often they do. And then they will also drive the roads in the area, look at the aerial photography, do all those types of things and see if you can find



additional evidence of surface faulting.
Q Doctor, did you do any of that work?
A Do any of -- we looked at the -- we looked at the deeper horizons. We drove the roads to look for them, and we looked at the aerial photography.
Q Sir, if I understood you correctly, that -- you were making a motion with your arm indicating that faults occur at angles, correct?
A Correct.
Q Now, as I -- if I were a bird or, as we say, a bird's eye view looking down on a fault -- correct --
A All right.
Q -- that, as you say, you find at the surface, if you do the trigonometry -- as you just said to the Judges -- where would that fault be located, say, at 6,000 feet? Where would you find the deep fault that corresponds to the surface fault that you claim correlates in some instances?
A It would depend upon the angle of the fault.
Q All right. And what do you understand the angles of the faults to be in the Conroe area? Is there a common angle?
A There's not a common angle. That's why I said they can be 45 degrees, they can be 60 degrees.



They can be higher. But if you're alerted to faults in the subsurface, then you go up dip and it will be a swath, it will be a path, maybe a couple of thousand feet that you've got to look at and you'll look for any evidence. I can't give you an exact location of where that fault is going to be, sir.
Q Well, sir, that's why I'm asking you. So then -- it would seem to me then, based on your testimony, that surface faults, to the extent that they are relevant at all, would only be after you did an evaluation to see whether or not, one, they exist in the subsurface and, two, whether they exist in the area of review. Because the surface fault in an area of review would certainly not be found in the subsurface in the same place, correct?
A Correct.
Q So showing surface faults in the area of review would not indicate faulting in the deep stratum in the area of review?
A It depends upon where your surface fault was located.
Q Well, and I'm following you, but if I take the surface fault and I do trigonometry at a 45-degree angle, let's say, what distance from the surface manifestation would I be before I found the subsurface



manifestation?
A It depends upon -- I said depends on -- are you talking about a particular fault or --
Q Well, I'm trying to understand what your testimony is regarding the surface faults. And you've just explained that you don't find them -- they're not perpendicular, right? There's no fault that occurs at a 90 degree angle, correct?
A Well, there are -- there can be faults that are perpendicular. These are probably at some angle.
Q Okay. So again, if I took your surface fault -- and is there a trend in terms of which side of the fault would be up thrown and which side would be down thrown?
A Many of the faults are down thrown on the Gulf Coast side, but that is not always the case, and especially when you're looking on top of a salt dome there is not a -- you have to look at the -- each individual fault and see what's the down thrown side.
Q Okay. Other than identifying surface faults, is there any relevance to the deep stratum that underlie the TexCom site that one could draw? I mean, in other words, is it your postulate that those surface faults indicate faulting in the deep stratum, specifically the lower Cockfield?

A Yes.
Q And how do you draw that conclusion, sir?
A As I stated earlier, you see faulting from the surface at various depths into the subsurface all the way down into the upper Cockfield, which is where most of the -- then on a regional basis you see some faulting in the lower Yegua, which is down at the level of the lower Cockfield or even lower.
Q Well, what causes a fault? In the various maps that you looked at, is it fair to say that some maps show certain faults and other maps don't show them. Is that a fair statement?
A That's correct.
Q Why is that?
A It can be a function of several things. It can be a function of the well control that was used. It can be a function of the data, the vintage of the map. At certain times -- let's stick with the Conroe field -- through the years, through the decades, they went back and gathered additional logs and additional data from certain wells. New technology came along and they were able to run what are called cased hole logs.

So, for instance, the applicant has based their fault identification on the 1936 map. By



the '70s, the oil field had developed gamma ray logs and also what are called pulse neutron logs. And as they were developing problems in the field, they had to get a better handle on the subsurface structure of the field.

So Exxon -- Humble Exxon -- went in and logged many of these wells with these gamma ray logs and with the pulse neutron logs. And that gave them just reams of new information that they didn't have for the 1936 map.

Thirty years -- I mean, 40 years later in the mid '70s, they had a lot of pressure data that they did not have with the 1936 map that the application is based on. This pressure data showed them that the field is very compartmentalized. So they came up and identified 144 different compartments within the field, and they attributed many of these to faulting. Some of them could be due do stratigraphic pinch outs, but they called these fault blocks within the field.

Q How many fault blocks are there, did you say?
A In 19 -- in the 1975 paper they identified 144.
Q And how large are these fault blocks?
A They're varying size.



Q Give me the variation, sir?
A We'd have to go back and look at the map. They would vary from just a few well locations up to hundreds of acres.
Q And in the area of the TexCom site, the area of review, what fault block, if any, did Exxon identify?
A Within the area of review they identified a number of these fault blocks, scores of these fault blocks.
Q Scores?
A Yes.
Q All right. And in what record that you've introduced into evidence reflects the scores of fault blocks in the TexCom area of review?
A It's in the 1975 Journal of Petroleum Technology Paper, but also in the various exhibits that Exxon provided in '72 and in '79 at Railroad Commission hearings.
Q Okay. I'm going to ask you, again, as precisely as you can, tell me the number of fault blocks in the area of review identified in those materials?
A I don't have a count on them. Exxon identified 144 fault blocks for the Conroe field.



Q How large is the Conroe field?
A It's about -- I think about seven miles long and about five miles wide.
Q So in seven miles long and five miles wide, assuming that to be correct, you're saying that there are 144 fault blocks, correct?
A That's what Exxon identified.
Q Okay. Do you disagree with Exxon? Do you agree with Exxon? Did you look at any back-up information or just their summary reports?
A I accept their publication.
Q All right. What is the significance of these fault blocks in this matter?
A Well, the applicant is charged with examining any faults within the area of review.
Q We're going to come to that, sir. But I'm asking you: What is the significance of the number of fault blocks? You throw it out as if it has significance because it sounds like a lot, 144. What is the specific significance of the fault blocks?
A And I was starting to answer that question --
Q No, you were --

JUDGE WALSTON: -- asked him the significance of the number of the fault blocks or of the fault blocks --

MR. RILEY: Well, I was going to ask the number of fault blocks. He keeps referring to the number of fault blocks.
JUDGE WALSTON: Sir, on your answers you keep trailing off and --
MR. RILEY: I'm sorry --
JUDGE WALSTON: -- tell the significance of fault blocks.
MR. RILEY: I'm sorry, Judge.
Q (By Mr. Riley) Here's what I want to understand, Mr. Collier. I'll withdraw the question and try to rephrase.
I want to understand when you throw out the number 144 whether the number of fault blocks has any significance by itself?
A Yes.
Q Okay. And in what regard does the number of fault blocks identified by Exxon in the papers you've mentioned have for this application?
A Because it shows, as you would expect with a salt dome structural field -- it shows how complicated it is and it shows how faulted it is, and that is what the applicant is charged with looking at. They are charged with looking at any and all faults -- and not just faults, but when you read their instructions,



they're even charged with looking at fractures. And a fracture is a break in the rock in which there has been no vertical displacement.
So the significance is to the number and to the -- whether you want to worry about the number or not, or whether you want to just talk about the significance of fault blocks is that this is what you have to look at to characterize the subsurface for this type of application. And this is the baseline data that you've got to have before you can do reservoir modeling. Because if you do reservoir modeling on the wrong size block --
JUDGE WALSTON: -- I think you are getting far from the question now.
WITNESS COLLIER: All right.
Q (By Mr. Riley) Doctor, are there faults -- again, I'm trying to drill down on the lines you drew on the map, specifically on page -- or Exhibit 1P -- whether those indicate these fault blocks or faults associated with these fault blocks in detail. In other words, are those all the faults that you say exist in the area of review?
A Those are all the faults that we found in the public records that we had access to.
Q And by "public records" you're also including



the Geomap private company record that you purchased, correct?
A Correct.
Q So, again, the number of fault blocks and Exxon's description of them, all of that information as it pertains to the area of review is contained in your Exhibit 1P, correct?
A You would not have 144 fault blocks. Of course we limited our -- the faults we delineated to the area of review.
Q What I'm trying to get to is that -- and I apologize if I seem vague -- but I'm wondering if the fault blocks that Exxon identified are different from the fault lines that you've drawn on Exhibit 1P?
A Some of them may be. Many of them would be -- I would think would be correlatable.
Q Okay. So there's a set of information that you've described that you did not plot on 1P. Is that your testimony?
A Exxon may have additional data.
Q Based on the records you reviewed and as you've described, all I'm trying to understand is within the area of review, are those the faults that you say exist based on the Exxon data and the other sources that you looked at?



A Yes.
Q Is it a complete list?
A Complete list is --
Q Based on the data you've reviewed -- and I'll do the preamble again -- but all the data you reviewed is your description on Exhibit 1P complete?
A Yes.
JUDGE WALSTON: Why don't we go ahead and take a break now. We've been going an hour-and-a-half.
MR. RILEY: Thank you.
JUDGE WALSTON: So we'll take a 15-minute break and resume at 10:45.
(Recess: 10:30 a.m. to 10:48 a.m.)
(TexCom Exhibit No. 73 marked)
JUDGE WALSTON: Back on the record. Mr. Riley?
MR. RILEY: Thank you, Judge.
Q (By Mr. Riley) Dr. Collier, could you look at what I've drawn, again rather crudely on the easel -- or the paper on the easel behind you?
A Yes.
Q Are you able to make out what I'm attempting to depict in that diagram?
A Yes.

Q All right. As you can see, what I've done is I tried to illustrate some portions of our discussion before the break as to how faults would be found at different horizons if indeed it extended -- or a fault extended through the various horizons. So if you'll follow with me, at the surface, which I think I've labeled No. 1 in the diagram. Then I made up a hypothetical horizon -- our first horizon which I labeled No. 2 and then a hypothetical horizon or second horizon that I labeled No. 3. Do you see that?
A Yes.
Q Now, if I drew a circle, a bird's eye view circle, over that geographic area -- again looking in two dimensions -- is it correct to say that I would see the fault line move in terms of geographic relationship across the circle as I went deeper?
A Yes.
Q All right. So if I have a fault at the surface of -- in a particular location, if it did indeed extend down into the subsurface, then as you said earlier it's a matter, to some degree, of trigonometry in figuring out where one would find it in the subsurface, correct?
A Yes.
Q And that -- my summary circle at the bottom



there is showing, again, in a bird's eye view, that if I was able to map accurately a fault that extended, as I've drawn it, I would actually show three lines moving across that circle, correct?
A Correct.
Q Now, let's talk about your Exhibit 1P. Am I correct that you did not attempt to correlate any of the subsurface faults to any of the surface faults that you describe in your testimony?
A Correct.
Q And am I also correct that regardless of whether you start at the surface or you start in a horizon, if the fault indeed extends downward or upward and you map a different horizon, you'd get the same phenomena that is depicted in the diagram Applicant's Exhibit 73?
A Correct.
MR. RILEY: And by the way, Judges, I've premarked that diagram as Applicant's Exhibit 73 and I'd offer it into the record as a demonstrative exhibit.
JUDGE WALSTON: Any objection?
There being no objection, Applicant's Exhibit 73 is admitted for demonstrative purposes only.



(TexCom Exhibit No. 73 admitted)
Q (By Mr. Riley) Doctor, is it fair to say then, if we are concerned with faulting in the injection zone that the best evidence of whatever type -- wireline, boring logs, well control -- whatever method one would use to describe faulting in the injection zone, the -- that's the interval of concern. Would you agree?
A Interval of concern as far as what?
Q Well, you've mentioned reservoir modeling. And while you know nothing about reservoir modeling, you said that faults were important for reservoir modeling purposes, correct?
A Correct.
Q All right. So one could assume that even with your basic knowledge of reservoir modeling, that the faults in the injection zone are the ones that will affect the modeling, correct?
A Correct.
Q So is it fair to say, then, for purposes of reservoir modeling that those are the faults we should be looking at?
A Yes.
Q Now, having said that, those -- as we have depicted on the board, those faults could move in and



out of the injection shown? In other words, you might find them at a higher stratum, but depending on the slope and depending on the trigonometry depicted, you may not find it, it may not exist, in the injection zone. Is that correct?
A No.
Q Within the area of review? Maybe I wasn't specific enough.
JUDGE WALSTON: Maybe you better restate the question.
MR. RILEY: I'm sorry.
Q (By Mr. Riley) I didn't try to draw this in the diagram, but let's assume that I started with a fault for purposes of our discussion to the northeast and assume that the diagram now has north to the top, south to the bottom, west to the left and east to the right? Is that fair?
A (Indicating)
Q Yes, that's fine. Yes. Okay?
A All right.
Q Now, if I started closer to the northwest side of the circle, by the time I got down to the injection zone, the fault could have moved or would have moved outside of the circle or outside of the area of review, agreed?

A That's possible.
Q So we are again concerning ourselves in terms of reservoir modeling with faults in the injection zone that could affect the modeling, correct?
A Correct.
Q So that is the horizon of concern. Would you agree with me so far?
A Correct.
Q So if I have faulting information, say, from the surface, it's not particularly relevant for any purpose regarding reservoir modeling. Would you agree?
A Well, depends upon where it is on the surface.
Q Okay. Again, using the trigonometry and -- again, I'm even going to go with you that all these faults go from the center of the earth to the surface and that they are findable or identifiable in the subsurface. But if it moves out of the area of review because of the trigonometry, then it's not of concern for reservoir modeling?
A Correct.
Q The mapping -- of all the data sources you looked at, which do you consider the most reliable?
A It would be the Exxon data.



Q Any particular report? Because the Exxon data is inconsistent even within itself, correct?
A I would not use the word "inconsistent."
Q It changed over time?
A Their -- different maps may show different faults.
Q Okay. Well, then, I think you'll give me, at least, that -- let's say in 1972 where the Exxon map showed a fault, if it didn't reappear, say, in the later Exxon mapping, what would you speculate occurred in that interval or in that time interval?
A I don't believe the fault has disappeared.
Q Do you think Exxon just neglected to map it again?
A They may have. It depends upon the purpose for which their later map was made.
Q So you would agree with me that all of Exxon's mapping, the entirety of Exxon's mapping, depends on what Exxon's motivation was in developing the map?
A Yes.
Q Now, despite not knowing Exxon's motivation or whether there were contrary maps offered in those Railroad Commission proceedings, the source of information, both for the applicant and for your



analysis, depends heavily on the Exxon mapping, correct?
A Correct.
Q And is that primarily because Exxon, having been -- Exxon and its predecessors -- having been in that field so long had the longest history of attempting to map or identify issues in the Conroe field?
A Correct.
Q Is it true that on all of Exxon maps, the entirety of Exxon's analysis, the faults that the Applicant put on it -- in its application show up in each case?
A I believe they do, yes.
Q All right. So at least we can agree, I hope, that the faults that the applicant depicted on its -- in its area of review, were consistently mapped by Exxon in the Conroe field in the area of review?
A Yes.
Q Do you have any disagreement with where the applicant drew those faults on its maps?
A No.
Q Would you agree that as -- well, let me say it differently. I don't want to get into qualitative statements, but would you agree that the off -- the



throw or the off-set for the -- what I'll call Fault No. 1 -- although there's probably a better way to refer to it -- which is the fault that extends to the southeast of the site across the area of review and is the longest line on the applicant's map, the big red fault. Do you see that one?
A Yes.
Q Would you agree with me that the throw on that fault is somewhere between 100 to 150 feet?
A I'll accept that.
Q Does that correspond with your review of the Exxon data?
A Yes.
JUDGE EGAN: Could you speak up a little bit, please?
WITNESS COLLIER: Yes.
JUDGE EGAN: Thank you.
JUDGE WALSTON: Can I ask you a question, Mr. Riley?
MR. RILEY: Certainly.
JUDGE WALSTON: Are you talking about this line here?
MR. RILEY: It is the big red line, yes. Unfortunately I haven't come up with a better way to refer to it. It's the -- you're exactly right, Judge.

JUDGE WALSTON: Okay. My question is I thought you said on the applicant's map. I thought this was his map.
MR. RILEY: It also appears on the applicant's map.
JUDGE WALSTON: Okay.
Q (By Mr. Riley) The second fault that the applicant identified -- and it is referred to in your legend as the -- again marked in red further south and a little further east of the fault we were just discussing -- is the second fault identified by the applicant, correct?
A Correct.
Q And do you know the throw on that fault?
A No.
Q Does it sound correct that it would be in the nature of 400 feet?
A I'll accept that.
Q Before you accept it, let me make sure of my -- I think that's correct based on the applicant's representations and the Exxon information.
Was it fair to say, Doctor, that all the other faults drawn on Exhibit 1P are substantially less in terms of offset or throw than the numbers we just discussed?



A I don't have the -- the throw on each one of those faults compiled.
Q Well, fortunately, I've taken the time to do that for you, and let me get an exhibit passed out and then let's resume our discussion.
(TexCom Exhibit No. 74 marked)
JUDGE EGAN: Would it be okay to ask a clarifying question just so I make sure I understand that testimony before it begins?
MR. RILEY: Of course. Yes.
JUDGE EGAN: I just want to get some nomenclature right. When y'all were talking about "throw," are you talking about the angle of the fault or are you talking about the depth of the fault or --
WITNESS COLLIER: The amount of movement along the fault line.
JUDGE EGAN: So how much difference there is between --
WITNESS COLLIER: If you take this right here, this horizon, if it moves down 20 feet, we have 20 feet of throw. So it can be 20 feet lower than where it is --
JUDGE EGAN: Okay. So 400 feet of throw is how much they've separated from each other?
WITNESS COLLIER: Yes.



MR. RILEY: Judge, you probably can see that a little better on TexCom Exhibit 72.
JUDGE EGAN: I've got it right here.
MR. RILEY: Okay. The throw is the vertical travel.
JUDGE EGAN: I understand. But I just wanted to make sure I knew what your nomenclature meant.
MR. RILEY: I understand. Thank you.
Q (By Mr. Riley) And we've been using two terms "throw" and "offset" and I apologize to everyone for doing that, but let's stick with offset as best we can, Dr. Collier. Are those synonymous in terms of our discussion?
A That would be fine.
Q All right. Now, it was marked -- I'd ask that the last piece of paper handed out be marked as TexCom Exhibit 74.
Doctor, could you take a moment and just take a look at what's been marked as Applicant Exhibit 74? And I think you'll see that it's -- unfortunately I didn't have time to make it more neat or -- more neat, but as an attempt to label with a number each of the segments you've depicted on your Exhibit 1P.
A I've looked at it.



Q All right. And just because I don't want to create a misimpression, there are some highlighted segments that we had some difficulty correlating to the Exxon data and would -- meaning nothing untoward, we have labeled with a highlighter and our little handwritten legend is "fictional." And I don't mean to be deprecating. It may be that we just couldn't find it in the Exxon data, but at least we had trouble correlating your line to any of the support materials.
MR. WALKER: Your Honor, at this time, I would object. Although this item has not been offered into evidence, I would object to that editorial comment as being a comment upon the evidence as opposed to something helpful to the Court.
JUDGE WALSTON: If I understood correctly, he might have picked a better word than "fictional," but he was at least just explaining --
MR. RILEY: Yes, sir. In fact, that was the reason I didn't want it to be anything more than what we intended it to be, which was our difficulty in locating the lines that Dr. Collier drew.
Q (By Mr. Riley) Dr. Collier, let me ask you a preliminary question. Did you draw the lines on this map?
A No.

Q Who did that work?
A I had my staff compile this.
Q And who among your staff do you know who actually worked an this diagram?
A Zack Irwin.
Q Is that it? Mr. Irwin?
A Lynn Smith. And then I reviewed all of the -- after they marked it, I looked at all of them.
Q Okay. So is it fair to say then, after these individuals compiled the exhibit, that you checked the work and you stand by it here today?
A Yes.
Q Okay. And at least in terms of methodology, do you see what I attempted to do in labeling each of the segments you drew with numbers?
A Yes.
Q And I came up with -- well, I shouldn't take credit for others' work. My colleagues and I came up with a total number of 31.
A Yes.
Q Now, our numbers 30 and 31 refer to the faults that were identified by the applicant, and Dr. Langhus specifically, that we depicted in the application and have discussed several times this morning, correct?



A Correct.
Q So 30 and 31 are just your reflection of the faults identified by Dr. Langhus and the applicant in the application, correct?
A No.
Q I'm sorry.
A The applicant and the application did not identify most of these faults.
Q No, I'm saying 30 and 31, sir.
A Oh, 30 and 31, yes.
Q Yes.
A Yes. Yes.
Q And then the rest of the items in this record are what you and your staff have added and you stand by here today?
A Yes.
Q Now, of the remaining faults depicted on your Exhibit 1P, are you able to go by number and tell us the offset for each of those faults?
A No.
Q Is that something that one could do based on the Exxon data?
A Yes.
Q You would have no data that contradicted the Exxon data, so whatever the Exxon data showed in terms



of offset, if these faults do -- indeed do exist in the injection zone, then it would be the Exxon data we would rely on for evaluation of these faults, correct?
A Yes.
Q Now, let's start, if you don't mind, with -- well, let me ask a more general question.
A Okay.
Q I know that you don't have it -- have the data on a fault or a segment-by-segment basis, but can you say in general terms what the maximum offset for all the other faults depicted on your Exhibit 1P, what is the highest offset that is reflected in your exhibit?
A I couldn't tell you offhand.
Q All right. The other day when Dr. Langhus was testifying -- I don't think you were present for the hearing in Conroe -- Dr. Langhus talked about the consistency that one would expect to see in the Jackson shale formation. In other words, what does it look like when -- if you were to pull up a wellbore and look at that consistency. Do you have an opinion on what the Jackson shale consistency would be or some common reference you could help us with?
A It's predominantly shale or clay or mudstone. It has little scattered sand lenses -- a few -- very



few -- sand to silty lenses in it. But the vast majority of it, 90-something percent is mudstone.
Q All right. And to the layperson, mudstone seems contradictory, but if I held a sample, let's say, out of a wellbore in my hand, can you tell me what the consistency would be like?
A It would be a clay or mud.
Q Would playdough be a reasonable way to describe how it would seem to a lay person?
A I guess you could use that. Or if you've been out in the field and gotten muddy boots and the mud sticks on your shoes, that's what we're talking about.
Q All right. So it would seem to be something that would not -- something -- it seems to be a stratum that would not transmit energy very effectively.
A By "energy" you mean fluid?
Q No, I'm saying -- by "energy" I mean energy. If someone were to hit, I guess, a bucket of mud, it would seem to me that the bucket of mud would dissipate the energy from a hammer hit so that it doesn't necessarily even penetrate down into the deep -- or to the bottom of the bucket.
A Well, I know what you're trying to get at,

but it will transmit energy. That's the whole theory and practice behind seismic is that you can -- you can transmit energy through it. Otherwise you would not been able to do seismic profiling.

Q Well, and seismic profiles are a matter of bouncing energy off of rock stratum and receiving the echo back and being able to make distinctions like what's mudstone, what's limestone, what's hard rock, things of that nature, correct?

A But your question was: Would it transmit energy? And to get to the underlying layers below a mudstone you have to transmit energy through the mudstone in order to get that energy below. So while mudstones do attenuate or while they do weaken the signal, energy will be transmitted through a mudstone.

Q Okay. And I'm sorry, I didn't mean to -- I wasn't really referring to seismic. I was more thinking about -- well, you've probably seen those fellows who, you know, either with their head or with their hand break bricks?

A That's seismic energy.

Q All right. And if one of those bricks was mud, would you expect the same result? In other words, doesn't some -- isn't there some factor associated with the brittleness of the material that



is struck?

A Yes, it would transmit a lot less energy.

Q So that would be fair then to say that the Jackson shale, a thousand foot in the area of the proposed TexCom well, would transmit energy, say, from above much less effectively than, say, a granite layer. Would you agree?

A True.

Q Would you expect any cracks in the Jackson to seal themselves if there were a crack in the Jackson shale?

A They may or may not. You have to look at the evidence -- the local evidence.

Q Fair enough. But as a matter of just the consistency of the formation itself -- at least I can imagine in my head -- it being difficult to keep the mud from merging back into itself.

A That's why studies have been done to see whether or not mudstones -- faulting in mudstones can be transmissive or not.

Q I understand that. But would you agree with me, at least on a consistency basis, that a mudstone is more likely to reform and seal than, say, a granite stone?

A Yes.



Q Now, would you define -- or would you describe the Jackson shale formation as a significant confining layer as it exists around the TexCom facility?

A It is a potential significant confining layer.

Q And a thousand feet of mudstone would seem to be pretty impermeable to fluid transfer. Is that fair?

A To the layman it would.

Q Well, how about to the geologist? As between sand and shale, which is more permeable?

A The sand is more permeable.

Q And as between sand and shale, would water tend to permeate the sand much more readily than the shale?

A The sand.

Q And can we assume that the rules that we all know fairly well in other contexts of the path of least resistance is where you would find the water or fluid traveling in a relative sense? In other words, you would expect, if something was bounded by shale on one side and a shale on the other side and sand in the middle, would you expect the water to transmit in the sand preferentially?



A Yes.

Q Let's go back to the exhibit -- Exhibit 74. Which of these markings indicate horizons mapped above the Jackson shale?

A Above the Jackson shale is just the one horizon, which is the -- it's the orange layer, top of Pliocene from Exxon Mobil 2002.

Q Okay. The orange layer --

A Well, it's orange color --

Q Orange color --

A -- so orange lines.

Q So the orange lines are -- I'm sorry, the one I have in front of me it's very difficult to read the legend. The legend hasn't been changed. It's from your Exhibit 1P, correct?

A Yes.

Q Let me just take a moment --

A -- second from the bottom is the orange color.

Q Okay. Let me just take out 1P. It will be easier for me to refer to it. Okay.

Again referring to your legend -- now that I can see it -- as you said, the indication is that the orange lines depict a mapping or horizon which is called the top of the Pilocene --

A Pliocene.
Q -- Pliocene, I'm sorry. And what does that mean to us lay folks as to where the -- where the horizon was mapped?
A This is approximately 500 feet below the surface.
Q So it's still a good distance, again looking at exhibit -- I'm not sure the exhibit has depths or thicknesses -- but it's still substantially above the Jackson shale formation, is it not?
A Correct.
Q The -- I note that -- I'm sorry, let me ask a different question first.
Are all the other faults that you depict on the exhibit, Exhibit 1P, mapped below the Jackson shale?
A All the other colors except that the --
Q And I'll call your attention to the dark green line. I'm not sure I have it correct, but is that also mapped below the Jackson shale?
A Yes. There are some of them that are mapped in the Jackson shale --
Q Okay.
A And that is the -- oh, that would be -- well, let me get -- the purple.



Q The purple are mapped in the Jackson shale?
A Yes.
Q All right. So at least the orange then we could say are well above, correct?
A Correct.
Q The top of the -- I don't guess top is the right way to say it -- but the depth perhaps to the upper Cockfield is 5,134 feet. You said you accepted that from the application previously, correct?
A Yes.
Q So the orange lines down to the top of the upper Cockfield are some 4600 feet?
A Approximately.
Q Tell me, if you can -- and actually we're about to go into some questions about the confidential information, Judge, and we just wanted to alert you to that.
JUDGE WALSTON: Okay. Is there anyone here -- maybe we need to go over the protective order -- that doesn't fit within the criteria? I believe everyone here is either a party or a named expert.
MR. FORSBERG: I may have a couple of individuals here who are not --
JUDGE WALSTON: That are not parties?



MR. FORSBERG: -- who may not be parties.
MR. WILLIAMS: We have one who is not one of our testifying experts.
JUDGE WALSTON: You have one what?
MR. WILLIAMS: We have one party here who is not one of our testifying experts.
MR. RILEY: If they're part of TCEQ --
MR. WILLIAMS: Okay.
JUDGE WALSTON: Are they part of the Commission?
MR. WILLIAMS: Yes.
JUDGE WALSTON: Okay.
MR. FORSBERG: If we could just be advised when that period of discussion of that topic is over so that we can invite her back?
MR. RILEY: Of course.
MR. FORSBERG: Thank you.
JUDGE WALSTON: Hang on just a second. Why don't we go off the record.
(Discussion off the record)
JUDGE WALSTON: Okay. Back on the record, and let the record reflect that all persons who are not authorized by the protective order to be in attendance have been excluded from the room.



And, Mr. Riley, you'll let us know when you're moving out of that topic and into something else?
MR. RILEY: Yes, sir.
(The following Pages 943 through 968 are CONFIDENTIAL and have been separately bound.)

JUDGE WALSTON: Then we'll go ahead and break for lunch. It's noon now, so we'll resume in one hour at one o'clock.

(Recess: 11:58 a.m. to 1:02 p.m.)



AFTERNOON SESSION
MONDAY, DECEMBER 17, 2007
(1:02 p.m.)

JUDGE EGAN: Let's go back on the record. It's about three minutes after 1:00 on December 17th, 2007.

Dr. Collier, you're still under oath.

And, Mr. Riley, you're in the process of crossing, so please continue.

PRESENTATION ON BEHALF OF
THE ALIGNED PROTESTANTS
(Continued)

HUGHBERT A. COLLIER,
having been previously duly sworn, testified as follows:

CROSS-EXAMINATION (Cont'd)

BY MR. RILEY:

Q Good afternoon, Dr. Collier.

A Good afternoon.

Q I'd like to start this afternoon by again referring back to your Exhibit 1P and discussing some of the light blue colored faults as you describe them in your prefiled testimony around the proposed TexCom facility.

JUDGE EGAN: Could you, where possible,



refer to the numbers that you've used as the location on your Exhibit No. 74?

MR. RILEY: Yes, Your Honor.

JUDGE EGAN: Thank you.

Q (By Mr. Riley) Give me just a second, Dr. Collier, to pull that out, and you a second and everyone else to get oriented.

Within your materials that you have with you, are you able to elaborate further on some of the back-up information that you relied upon in drawing the various lines on this map?

A Yes.

Q Okay. Let's start -- let me first get my key so we can follow along. We have labeled one segment that you've drawn on Exhibit 1P, a line that we have -- or given the number 14A. Can you find the source material for the line you drew as a fault that we've labeled 14A?

A That's in Exhibit M, the second page, which is first main Conroe -- first main Conroe sand map.

Q And within that exhibit and with respect to that line, can you look at your source material and determine whether indeed it depicts a fault or a water contact?

A It's hard to tell looking at the map. I



originally identified it as a fault. It could possibly be a water contact on here.

JUDGE EGAN: It could be a what?

WITNESS COLLIER: A water contact.

Q (By Mr. Riley) What is a water contact, Doctor?

A Well, what they're showing is if you look at the color coding -- actually they're not showing it as a water contact. Their light green colors are their -- let me pull it up. The darker green color here is what they labeled a gas cap shrinkage. And there's a lighter green color and that's remaining original oil zone. And then you see -- if you come south of it towards the southeast since it's kind of oriented towards that way, that's remaining original gas cap.

So what there it could be possibly showing is a contact between the original -- well, they're showing it all as being gas cap and they're looking at the amount of shrinkage. And they -- they're looking at the contact between the gas cap and the oil. So it could be a gas/oil contact there.

Q Okay. But you've depicted it on your Exhibit 1P as a fault, did you not?

A Yes.

Q And that's incorrect, is it not?
A Yes, it could be.
Q No -- is it or is it not?
A Well, the map is so small and their contact -- it probably -- I'll say it's incorrect.
Q All right. By the way, Doctor, back-up information for these maps that you've included is available at the Texas Railroad Commission. Is that correct?
A Correct.
Q Have you looked at any data, raw data, that went into compiling of the maps that Exxon -- that you relied upon from Exxon?
A I did review the information.
Q You did review the information. When did you do that?
A When we collected all of the records.
Q Okay. Now, Doctor, did you personally go to the Railroad Commission and look at the back-up information that supports the various maps that you've introduced with your testimony?
A I personally went to the Railroad Commission and pulled the information with the files.
Q So when I asked you this question in your deposition -- what date was that, then?



A It was a couple of months ago we went -- a month or two. I don't remember the exact date.
Q Certainly prior to when I took your deposition in Conroe in this matter. Is that correct?
A Oh, yes.
Q So when I asked you the question of whether you looked at any of the data that supported the Exxon maps and you indicated you had not, was that correct?
A I looked at the data in the files. A lot of the data on which this map is based upon is not in the files.
Q Well, I'm going to find the deposition question and I'll read it to you and see if your answer was truthful at that time. Just give me a minute. We'll come back to this.
A All right.
Q Moving on though, Doctor, with respect to the segment that we've labeled 14B -- you find that on your Exhibit 1P?
A Yes.
Q And what is the offset for exhibit -- excuse me, for Segment 14 -- I'll say 14B -- yes, 14B?
A It's -- again, it's very hard to read the contour lines, but it's -- those are 50-foot contours. It's less than 50 feet.



Q And in what exhibit are you referring to it being less than 50 feet?
A The same one we've been talking about.
Q Is that Humble Exhibit 8?
A Yes.
Q Okay. Could you look at Humble Exhibit 9?
A All right.
Q And in Humble Exhibit 9 would you agree that it's somewhere between 10 and 40 feet -- I'm sorry, 15 and 40 feet. I apologize.
A I'll accept that. Again I can't read the numbers on the map.
Q Where is Humble -- where is the horizon that is depicted in Humble Exhibit 8 versus the horizon that's depicted in Humble Exhibit 9?
A The Humble Exhibit 8 sand overlies the Humble Exhibit 9, which is the second main Conroe sand QA member.
Q So we are moving deeper in the upper Cockfield. Is that correct?
A Correct.
Q We're not into the middle Cockfield. We're moving within the sands in the upper Cockfield, correct?
A Correct.



Q So as we go from Humble Exhibit 8 down to Humble Exhibit 9 -- and by down I mean deeper into the earth, correct?
A Correct.
Q And would that also be true for Humble Exhibit 10?
A Yes.
Q We're still going deeper in the upper Cockfield -- not into the middle, but still in the upper Cockfield, correct?
A Yes.
Q And the throw -- or, excuse me, the offset in Humble Exhibit 10 for that same indication on the Humble map is approximately 40 feet. Is that correct?
A I'll accept that.
Q I'm sorry, I mischaracterized it. Somewhere between 10 and 40 feet?
A I'll accept that.
Q And finally on Humble Exhibit 11, again going deeper, correct, in the upper Cockfield --
A Yes.
Q And it shows to be somewhere on the order of 40 feet offset. Is that correct?
A I'll accept that.
Q And then Humble Exhibit 12, which is, again,

deeper into the upper Cockfield, above the middle Cockfield, shows that there's no fault. Would you also accept that?
A You have to be careful how you phrase it.
Q All right. Well, it doesn't show a fault on the depiction, does it?
A Right. And it shows no data. They had no data there.
Q All right. That's your understanding, correct?
A That's what the map shows.
Q That's what the map shows. That's your understanding, correct?
A Correct.
Q Again, we are -- based on our earlier discussion from this morning, we are still talking -- if we look at TexCom Exhibit 72 -- about the horizons in the upper Cockfield just below the Jackson shale, correct?
A Correct.
Q We are not talking about any mapped horizons in either the middle Cockfield or the lower Cockfield, correct?
A Correct.
Q Doctor, do you have an opinion as to why



Exxon was particularly interested in mapping the upper Cockfield?
A The upper Cockfield is the zone they're producing out of.
JUDGE EGAN: I'm sorry, you're going to need to speak into the mic.
WITNESS COLLIER: It's the zone they were producing out of.
Q (By Mr. Riley) In fact, in the history of the Conroe field, the upper Cockfield is the productive zone. Is that correct?
A Correct.
Q And there is not production -- or has not historically been production from the middle or lower Cockfield. Is that also correct?
A Correct.
Q Would it indicate to you, Doctor, as an expert geologist, that the Jackson shale is an intact barrier layer or confining unit by the fact that for some 70 years there's been oil and gas production from the upper Cockfield?
A That statement is not entirely true.
Q All right. If there were fractures or faults in the Jackson shale that were transmissive vertically, would that not have led to release of the



hydrocarbons beneath it?
A Yes.
Q So is it again evidence that the Jackson shale is a confining unit, that it has secured hydrocarbons that have been produced for more than 70 years?
A No.
Q Doctor, the -- I found no fault -- again, based on your evaluation of back-up information -- I found no line that you've drawn, no fault that you say exists, other than the two identified by the applicant that showed an offset -- a vertical offset of more than 60 feet. Do you disagree with that statement?
A I'll agree with that.
Q Earlier today we discussed a Fall-off test. Do you remember that discussion?
A Yes.
Q And while I don't think you had very detailed familiarity with Fall-off tests, are you familiar with the term of "radius of investigation"?
A Yes.
Q What does that mean?
A That's the distance out for which the test is characterizing the zone that's being tested.
Q All right. Are you familiar with whether



zone -- excuse me, whether a Fall-off test can depict boundary conditions?
A Yes.
Q And in fact, boundary conditions, Doctor, why don't you explain what boundary conditions are?
A A boundary condition could be a ceiling fault. It could be a pinch-out of the unit that's being tested. For instance, if it's a sand -- let's say you go out a thousand feet and the sand is no longer present there, it becomes an impermeable barrier. Various types of things you can detect if you have a boundary condition -- it could be a fault. It could be what geologists call a pinch-out.
Q It also could be an opening into a more transmissive sand, could it not? It simply measures a differentiation and pressure at a boundary. Is that correct?
A Correct.
Q So it is neither -- it doesn't have to be a ceiling feature, it could actually be a more transmissive sand, correct?
A Correct.
Q And are you aware of the radius of investigation for the Fall-off test?
A No.

Q If I represented to you that it was 1500 feet or more and showed no boundary conditions, can you reach any conclusion?
A If it -- if it looked at 1500 feet and showed no boundary conditions based upon that test, for the interval that they were testing, you could surmise there's no boundary condition.
Q So you would think though -- well, is the test valid for consideration in this case?
A It would be evidence that you would want to look at, yes.
Q And it would still, whether it's a -- let me withdraw that question --
You relied on earlier in your testimony saying what you thought the applicant should have modeled in terms of permeability, correct?
A Yes.
Q And for that reason you must think that the Fall-off test was reliable, correct?
A Yes.
Q And even though it perforated different sands than the applicant proposes to perforate within the same injection zone, would you also agree the test is valid in determining whether there are any boundary conditions within the radius of investigation?



A For the radius investigation for the interval that was perforated in the test.
Q Okay. Well, if the interval that was perforated was 100 feet or 90 feet, and it was perforated in the lower Cockfield sand, would you find it to be helpful in evaluating any boundary conditions in the lower Cockfield sand for a radius of 1500 feet?
A Yes.
MR. RILEY: May I have just a minute, Your Honors?
JUDGE EGAN: Yes.
Q (By Mr. Riley) Doctor, I'd like to call your attention to your Exhibit 1Q in the application. If you would take a moment and pull that out, let's discuss one of your notations on that exhibit.
A I have it out.
Q All right, Doctor, there is a notation on the TC Howell survey that gives an API number. Can you tell us what an API number is?
A It's the American Petroleum Institute, and it's a unique number assigned to -- at least to modern days assigned to every well.
Q All right. And is it correct over the course of time, Doctor, the APA -- excuse me -- the API numbers are relatively recent developments? In other



words, most wells don't have API numbers. Is that correct?
A Yes. I don't know if -- many of the old wells pre-fifties or forties, somewhere in there, they wouldn't have them.
Q All right. And, Doctor, I think this is, to some extent, a function of mislabeling in the application of a boring log or a log -- excuse me, I guess it's an electric log -- of -- that was labeled in the application C-425, and you've indicated on this exhibit that the log total depth is 12,494 feet?
A Correct.
Q And that -- was that because you found it in the application labeled -- I'm sorry -- labeled C-425?
A Correct.
Q Could you take a minute and look at that log, if you have it before you?
A I don't have it with me.
Q All right. Let me provide you a copy. But it is in the applicant's exhibits in the well logs Volume 3 of 15, Page 58 of 58. So it should be right at the back.
Do you have it now in your hand, Doctor?
A Yes.
MR. RILEY: Does everybody else have it?



Q Doctor, if you'd look at the -- first of all, the applicant labeled the document C-425. Is that correct?
A Correct.
Q And that was your reason for identifying with the map that's depicted in your Exhibit 1Q?
A Correct.
Q If you look at it a little more closely perhaps, could you -- do you find where it describes the location of that well or the well that that log represents?
A Yes.
Q And that would be 500 feet from the -- and it's FNWL, and that stands for from northwest line, correct?
A That's correct.
Q And 800 feet from east line, correct?
A From the east line of the lease and survey.
Q And would you agree with me that that corresponds on the map to Well No. C-426? If you'll look at a dry hole up in the TC Howell survey in the upper left-hand -- excuse me, right-hand portion of that survey?
A Well, it may. It depends on where they put the northwest line.

Q Does the well log --
THE REPORTER: I'm sorry, I didn't hear the end --
MR. RILEY: I'm sorry, there was something --
WITNESS COLLIER: That was me.
Q (By Mr. Riley) Does the well log indicate that it was a dry hole?
A The well log does not indicate that it was a dry hole.
Q Okay. And the -- as best you can tell from looking at the depiction -- or the description in the well log of the well location -- can you -- can you identify the well log as relating to C-426?
A As far as the description? As far as the location?
Q Yes, sir.
A It's not going to agree exactly, because it says it's 500 feet from the northwest line and 800 feet from the east line.
Q But it's certainly not Well 425. Can we at least agree that far?
A Yes.
Q That is the well log that you're relying on for the depth that you associated with Well C-425,



correct?
A Yes.
MR. RILEY: Thank you, Doctor. I have no further questions and I pass the witness.
JUDGE EGAN: Mr. Williams?
CROSS-EXAMINATION
BY MR. WILLIAMS:
Q Good afternoon, Dr. Collier. My name is John Williams. I represent the Executive Director.
JUDGE EGAN: Microphone.
MR. WILLIAMS: I'm sorry. Thank you.
A Good afternoon.
Q Can you hear me now?
A Yes.
JUDGE WALSTON: Yes.
Q Dr. Collier, does every fault visible at the surface extend 6,000 feet below the surface?
A No.
Q Do some faults that are visible at the surface extend that deep?
A Yes.
Q Does every fault that exists at 6,000 feet below the surface extend upward to the surface?
A No.
Q Do some?



A Yes.
Q Is it your position that every fault within the area of review that you mapped in your Exhibit 1P, does every one of those faults extend upward to the surface?
A No.
Q What stops them?
A Some faults will die out structurally and -- they'll just -- they just die out. At the end they terminate.
Q Okay. Is it your testimony in your prefiled that all of the faults that you've depicted in Exhibit 1P are transmissive laterally across the faults?
A No.
Q Can you be more specific which ones are and which ones aren't?
A No.
Q Are all the faults that you depicted in Exhibit 1P transmissive vertically upward?
A No.
Q Do you know which ones are?
A No.
Q You mentioned in your prefiled -- on Page 11 of 41 of your prefiled testimony, you mention on Line 3 about liquids injected are connate. Can you please



explain what connate waters are?
A Connate water is -- a lot of logging people use it to refer to the naturally-occurring fluids that are in a formation.
Q Thank you.
MR. RILEY: What page was that on?
JUDGE EGAN: Page 11.
MR. WILLIAMS: Page 11 of his prefiled.
JUDGE EGAN: Line 3.
MR. WILLIAMS: Line 3.
Q (By Mr. Williams) On your Exhibit 1C, the photographs of faults -- the one, two, three, fourth page -- Mr. Riley was asking you about the Big Barn East Fault. Can you tell me what in that photograph tells you that there is a fault there?
A You notice from where the vehicle is parked coming back out towards us, you notice there's a section of the road that's repaved.
Q Okay. The lighter part of the photograph?
A Well, it's the dark part you see --
Q Okay. The dark part.
A The dark part. That is repaved. This is a fault -- and I misspoke earlier. It's Carl Norman, N-o-r-m-a-n, not Newman.
Q Right.

A This is a fault that Carl Norman has been monitoring for over 20 years. And what you see here is that periodically you get enough of a bump in the road that they have to go in there and smooth it out and repave part of it. And that's what they've done here.

Q Okay. Some of these other faults -- other photographs showing cracks in the pavement, how do you distinguish cracks in the pavement from a fault from cracks in the pavement because of some failure of the subbase in the road?

A That's a good question. You want to, one, look and see if there's any evidence for anything subbase in the -- along that part of the road. Is there a culvert? Is there something else extending out on either side, maybe a previous road?

If you don't find any kind of evidence for something that could have collapsed, you look for subtle or not-so-subtle differences in elevation. It's basically a bump in the road. You go from one side of these cracks to another. And when you feel that bump and you get out and look at it, and you see that there is an offset, that is evidence to support that that is -- there's strong evidence that could be a fault. Certainly not every crack in the road is a



fault. And we that -- there were some of these roads that had a lot of cracks going straight down the road for a long distance. And we got on -- the further we looked we saw that was just poor road construction and poor subbase.

There's a linearity to it that also sometimes you can -- you can see extending very subtly off on either side. You may see this continue off across the road and a subtle change in elevation.

Q Okay. On your Exhibit 1O, the map of these surface faults, to the left of the four proposed TexCom wells you've got a long curving yellow line, and you've got the -- the name is "Lineament." Could you explain what that is and how you discovered that?

A Yes. Underlying most of that yellow line, you can see -- this is based upon -- I think this is a LIDAR image and you can see the subtle indication underneath that line for much of the length of a little drainage. And you can see how the drainage kind of lines up in a slightly curved area.

This was one that was pointed out to me by Bob Ringholz with Fugro Geophysical. They had a retired geologist who was -- who is a contemporary of Carl Norman, and that's what he specializes in. So he was not willing to identify this as a fault, but it's



a linear -- to curve a linear feature that many times those prove out to be faults. But you don't have enough evidence here, so you just call it a lineament, which means it's really an abnormal or -- you don't normally see those types of straight to slightly curved features on the surface.

Q Okay. And on your Map 1O you have identified a feature known as a sinkhole down toward the southeast perimeter of the two-and-a-half mile radius. There's a blue letter "I" marking the spot. Is that the sinkhole you have pictures of in Exhibit 1C?

A Yes.

Q I have to admit I'm having trouble seeing a sinkhole in these pictures. Could you help me identify it?

A Notice sinkhole is in quotation marks.

Q Okay.

A I didn't know what else to call it. The feature is so large that it is -- it is very hard to get it within any pictures.

Q Okay.

A So it's -- notice there's a chain-link fence around it. It's a large elliptical-shaped body. Then the trees -- really kind of the edge of it starts with that brush line or tree line inside the fence.



Q Okay.

A And when you read the articles about the early development of the field, they lost a drilling rig on one location. They lost a christmas tree on another. They had a collapsed feature that resulted in a feature 200 feet in diameter and about -- they estimated to be 800 feet deep. So they had a number of blowouts. That's why took the pictures and that's why it's in quotation marks.

Q Okay.

A It's not a classical geological sinkhole.

Q Right. Could you explain what a christmas tree is in the oil business?

A A christmas tree is the structure that sits on top, and it's the -- the valves, the piping, that controls the access to the well and by which the gas flows out. It kind of looks like a -- I guess a roughneck's christmas tree.

Q It's not like in a building construction where they put the juniper on top of the building when they finish the --

A No, no.

Q No? Okay. In a couple of places in your prefiled -- and I'll direct you to Page 23 of your prefiled testimony --

A (Witness complies)
Q -- on Lines 11 and 12, you say, "This also means that the application is administratively incomplete."
A Yes.
Q Do you see that?
A Yes.
Q Have you ever worked for or been an employee of the TCEQ or any of its predecessors?
A No.
Q I remember you saying that you've worked on Class II well applications. Have you been involved with any applications before the TCEQ or its predecessors?
A No.
Q In your experience with Class IIs before the Railroad Commission, do you get notices of deficiency on those applications?
A I never received any.
Q Okay. But you're familiar with the NOD process --
A Yes.
Q -- in general?
Do you have a working idea of what things, either at the Railroad Commission or TCEQ,



that staff look for in their administrative review of an application?
A Yes.
Q And could you please give us an idea of what those things are?
A Well, in the context of this they're looking for all of the wells that's within the two-and-a-half mile area of review. And the term may be incorrect there "inadministratively" incomplete. Certainly there are a number of -- there are approximately 100 more water wells within the two-and-a-half mile area of review than what the applicant identified.
And so I will admit that the term "administratively incomplete" may be incorrect, but the technical part of what they submitted is certainly incorrect, for which TCEQ, you know, may or may not have had any knowledge of that. All they could go on was the map that was provided, and that map was taking the Water Development Board groundwater data base with wells that have state ID numbers, and that's the only base that they utilized to prepare that map.
Q Okay. So are you willing to admit then that this -- instead of being administratively incomplete, this application could have been technically incomplete with this information?



A Yes.
MR. WILLIAMS: I'll accept those answers and pass the witness, Your Honor.
JUDGE EGAN: All right. Any further -- any further redirect, Mr. Walker?
MR. WALKER: Yes, ma'am. Just a few questions, if I may.
REDIRECT EXAMINATION
BY MR. WALKER:
Q Dr. Collier, you were asked about the Big Barn East Fault. Do you recall that line of questioning?
A Yes.
Q How close does the Big Barn East Fault get to the area of review based upon your observation and research?
A It is right on the edge, but within the two-and-a-half mile area of review.
Q All right. Is there a particular reason or rationale for not classifying a fault as major or minor if in fact one doesn't so classify?
A Yes. Again, as I mentioned this morning, it would depend upon for what purpose you were identifying faults. And in the context of the application, the applicant is charged with identifying



the presence of faults and fractures, and then having identified them, to look at every one and decide whether or not they're transmissive. So it makes no difference if it's a major or minor fault. Major and minor faults can both be transmissive. They can be conduits for the upward or the downward movement of fluid. So in that regard it doesn't make any difference if it's major or minor.
Q Is it possible for fluid to migrate through or along a fault that has a four- or five-foot throw?
A Yes.
Q I think there has been some discussion earlier, Dr. Collier, of a lack of correlation --
MR. RILEY: Mr. Walker, could I ask you to speak into the microphone? I'm having trouble hearing you.
MR. WALKER: I'm sorry.
Q (By Mr. Walker) I think there was some previous testimony about the lack of correlation between the map fault lines. Is there perhaps some explanation you can give for that fact I guess?
A Yes, if we look at a couple of consequences, I was questioned earlier regarding my exhibit -- let me make sure I have the right one -- Exhibit M, which is from the 1972 Railroad Commission hearing. And

your question is, is there a reason for lack of correlation from one map to another, from one strata to another. And we walked through Humble Exhibit 8, 9, 10. And then on 11, most of the faults right up close to our injection wells, those faults disappear. And the reason they disappear, there's no well control. The wells didn't go deep enough.

And so if the wells don't go deep enough, you have no data to do any mapping. That's why you notice that there's no contour lines over virtually all of the TC Howell survey on Humble Exhibit No. 11. There aren't any at all on Humble Exhibit No. 12. And you see the same thing on Humble Exhibit 13 and 14.

And what you see is the area that they're mapping shrinks as you go from 8, 9, 10, 11, 12. And the area that they're mapping shrinks because they don't have any well control. They don't have any wells that went deep enough.

So are there faults on the map? No. Are there faults that exist there? The map doesn't tell you one way or the other because they had no data for that interval. And that's the same rationale for the Geomap maps. They didn't map all the faults. And for many of these others you have quote -- in



quotation marks discrepancies from one map to another depending upon the number of logs they had available the wells they used. And that's why these differences.

Q Thank you, Dr. Collier. Let me ask you if you recall the testimony concerning TexCom Exhibit 74 and a reference to a line on there that was designated 14A. I believe you testified that that reference or that designation was incorrect. Is that right?

A Yes.

Q If you subtract that particular designation, how many faults did you discover in your research within the area of review?

A That makes 23.

Q Let me ask you this: How many faults did the applicant designate in the application?

A Two.

Q Dr. Collier, during your review of the TexCom application, did you have an occasion to review Rule 331.121 of the Texas Administrative Code?

A Yes.

Q What is the requirement set forth in that particular rule with respect to delineation of faults?

MR. RILEY: Objection.

JUDGE EGAN: Your legal basis?



MR. RILEY: My legal basis is this witness is not a legal expert and cannot interpret the TCEQ rules, and has never worked in this area, which would be another reason for objecting.

JUDGE EGAN: Other than -- you want to lay a better predicate?

MR. WALKER: Thank you, Your Honor.

Q (By Mr. Walker) Dr. Collier, is there a -- is there a qualification for the kinds of faults that are to be set forth in the application?

A None.

Q Anything, as far as you know, that only major, substantial faults are to be designated?

A No qualifications in regard to that.

Q In your experience as a hydrogeologist, Dr. Collier, why is it important to locate all of the faults that can be located, within the area of review?

MR. RILEY: Objection. Same objection. He's never done an application for any type of well -- disposal well, Class II or Class I -- and this is obviously referring to an area of review being a regulatory requirement, not some generic term; therefore, I don't think he's qualified to answer that question.

JUDGE EGAN: Overruled.



Q (By Mr. Walker) You can answer the question, Dr. Collier.

A Any time you do any kind of study of the subsurface and you want to determine if you can have vertical migration from one bed to another, not only do you have to look at those beds and the properties of those horizons or beds -- and in this case we'll take the Jackson, which is a thousand feet of mudstone and shale, on its own, if there was nothing else, that would be a suitable confining unit and a barrier to vertical migration.

But if you have faults in the area -- or if you have artificial penetrations, but we're talking about faults here -- if you have faults in the area below it and above it and in it, then that's a big red flag, and you have to look, as is required in the application, to look at all the faults and identify them because they can potentially be transmissive.

Q How many faults, Dr. Collier, did you -- or have you located that extend down into the upper Cockfield area?

A 19 of these.

Q Does that involve having excluded the one that was referenced as 14A on Exhibit 74?

A Yes.

Q Do you know, Dr. Collier, if all of those faults, those 19, extending down into the upper Cockfield, are they transmissive?
A No, I do not know if all of them are.
Q Do you know if none of them are transmissive?
A I do know that that is not correct. Some of them are transmissive.
Q All right. With respect to your research in this particular case -- and let me direct your attention to the 1975 paper, the Whitson, Davies and Burns paper -- did you find any information that reflected fluid migration through any mudstone in the area of review?
A Yes, that's one of the -- that paper is Exhibit I. Exxon was having trouble in the field because they were losing their gap of gas from these main Conroe sands, and the gas was migrating upward into the upper Cockfield. That's that pipe log that we looked at earlier.
And if you turn to I and turn to the second page, which is Page 814, and look at Figure 2, that's the type electric log. And so you see this box around first main Conroe sand and 2 through 6 main Conroe. Those producing intervals were losing the gas up into the upper Cockfield.



So Exxon started doing a study, and this study is referenced in some of the other Railroad Commission hearings. And what they found was they were losing their gas because of a pressure differential and they developed the field. And the gas was in part migrating up fault lanes. So they even drew a diagram of this that -- they didn't put it in the 1975, but they put it in their Railroad Commission hearing that we've been referring to here earlier today, the 1979 hearing.
If you turn to the last page -- that's J. And if you turn to the last page of J -- the next-to-the-last page. The last page is this plastic with a map inserted. And turn to the page before that, and you can see Exxon's work in '72 and everything was put together in the '75 paper.
And they show you the conduits -- the three conduits that they said existed within the Cockfield. One was communication through wellbores and behind pipe.
JUDGE EGAN: And what?
WITNESS COLLIER: Through the wellbores and behind pipe, behind the casing.
JUDGE EGAN: Okay.
A And in the 1975 paper they talk about that



the cement had deteriorated in some of the wells. So in the 1975 paper they have a mathematical formula for modeling fluid flow behind pipe, behind casings, out in the angular space. They had to include that in their reservoir modeling.
The second conduit that they identified, going back to this Exxon Exhibit No. 31, the next-to-last page, is migration across faults due to juxtaposition of sands. And then the third one on the far right is migration of fault plain to shallow sands.
Q Dr. Collier, let me ask you, in your professional opinion, hydrogeologically how would you categorize the subsurface geology, given everything that you've talked about today, of this area of review -- simple, complex -- how would you categorize it?
A It's complex. The faulting here makes it complex. There are a number of faults scattered throughout the Conroe field. And there are a number of faults scattered throughout the area of review. Most of them are in the subsurface, but there is a surface expression of the lineament and one fault even on the surface. There is -- it's very complex because there's faulting at 500 feet; there's faulting within



the lower part of the Jackson confining unit that was mapped back in the 1950s in a field trip guidebook; and then there's faulting in various -- in all these zones within the upper Cockfield.
And then when you skip to the Geomap and look at the base of the Yegua or the lower part, the base of the Cockfield, they catch -- even in their very simplified map in the sense they didn't try to look at every well -- even just selecting just a few well logs and mapping they caught faulting below at the base of the Yegua as well. So it's very complex structurally.
MR. WALKER: Thank you, Dr. Collier. I'll pass the witness .
JUDGE EGAN: Lone Star?
MR. GERSHON: No questions.
JUDGE EGAN: Mr. Forsberg?
MR. FORSBERG: Nothing, Your Honor.
JUDGE EGAN: Ms. Collins?
MS. COLLINS: No questions. Thank you.
JUDGE EGAN: Mr. Riley?
MR. RILEY: Yes, I have several.
JUDGE EGAN: Be reminded that this is recross.
MR. RILEY: Yes, ma'am.

CROSS-EXAMINATION

BY MR. RILEY:

Q Doctor, I thought I understood you to say that there isn't adequate data in the Exxon materials to determine any faults in the lower Cockfield.

A The faults that are determined in the lower Cockfield are not in the Exxon data. I never said that.

Q I'm asking you, when you were going through this just a moment ago with Mr. Walker, and you were explaining why you think there is faulting that must be considered in this application, I'm asking for your evidence of any faults in the lower Cockfield?

A That is the Geomap structure map on Horizon B.

Q So I should look simply at the Geomap structure map on Horizon B for all of your evidence of faulting in the lower Cockfield?

A Well, that needs to be -- no, I would not just look at that. That is the only map that's present mapped on that horizon.

Q Okay. Let me try one more time. Tell me all of your evidence and indicate to me where your faults are found on Exxon materials or otherwise that are mapped in the horizon that we've been discussing, the



lower Cockfield.

A The Exxon did not map the lower Cockfield.

Q Is your answer then, Doctor, that you have no evidence of any faults in the lower Cockfield?

A I have no evidence of any maps constructed on the lower Cockfield.

Q Okay. What is all your evidence of all the faults in the lower Cockfield?

A The faults that are found in the upper Cockfield, there is good geological -- a valid geological conclusion is that some -- not many or all of these faults -- would extend even into the lower Cockfield.

Q Well, which ones, Doctor? Since you have valid, geological conclusions and good science behind your opinion, I'd like for you to be specific as to which faults extend into the lower Cockfield.

A Any or all of them are capable of extending into --

Q That's not my question, Doctor. Based on -- in your opinion, in all the data you've reviewed and all the time you've spent on this application, I would like you to tell me which of these faults extend into the lower Cockfield.

A As I said, any or all of them can extend into



it.

Q Or none of them could. Is that also true, Doctor?

A No, because you see that with the faults that you have -- that the applicant identified.

Q So you're certain of two, the ones that the applicant has in its application, correct?

A Yes.

Q So the other faults you have no evidence, zero, none at all, that they extend into the lower Cockfield, correct?

A There are not maps constructed on that.

Q So you have no evidence, Doctor, that those faults that you've depicted extend in the lower Cockfield, correct?

A Correct.

Q You explained to Mr. Walker just a few minutes ago that you are able to determine which of those faults are transmissive. Is that correct?

A No, I did not say that.

Q You said that you knew that some of those faults were transmissive, correct?

A Yes.

Q How do you know that if you're not able to tell us which faults are transmissive?



A Because Exxon in their studies show that certain faults within the field are transmissive.

Q Okay. Which faults did Exxon show are transmissive?

A They do not identify which particular faults.

Q Well, that's your conclusion, that Exxon did not identify where it was losing its gas cap and which wells were involved?

A They identified throughout the whole field. They did not -- they did not do a compilation of which faults were transmissive and which were not.

Q My question is different, Doctor. Were they discussing certain wells in which they were losing their gas cap?

A They were discussing the whole field.

Q They were discussing the whole field. They did not explain any further or detail in any greater detail where they were losing production because of the loss of the gas cap?

A Not that I remember.

Q You said that Exxon explained that it had three reasons -- I'm sorry, you said that Exxon was concerned that it was losing its gas cap, correct?

A Correct.

Q And can you tell me, Doctor, the difference,

if any, between transmissivity of gas and fluid in substrata?
A Gas will be more transmissive than a liquid.
Q Okay. So it is possible that gas could transmit through these faults and liquid would not, correct?
A Correct.
Q So the indication of gas transmission in a fault is not necessarily indication of fluid transmission, correct?
A Well, gas is a fluid.
Q You understand what I mean, correct?
A Correct.
Q So gas transmission as opposed to oil or water would not indicate that oil or water could transmit across that same fault, correct?
A It is -- you could have cases where that could be the case, but it is an indication that the fault is transmissive.
Q Did you find anywhere in the -- well, transmissive, but again transmissive must be qualified in terms of what is transmitting across the fault, correct?
A Correct.
Q So back to my question: If we're talking



about water, there is no evidence in the Exxon materials that any of the faults described by Exxon that were causing a loss of its gas cap are transmissive of water, correct?
A Correct.
Q Nor is there any indication that those faults are transmissive of oil. Is that also correct?
A Correct.
Q In fact, Doctor, there's no indication that oil production was lost in the Exxon studies, correct?
A (No response)
Q Other than through loss of the gas cap, which depressurizes the reservoir, there is no indication that oil was leaking through the Jackson shale into upper zones. Is that correct?
A Through faults, correct.
Q We'll go to artificial penetrations in a minute. But through faults you found no evidence that any of the faults are transmissive or water or oil, correct?
A Correct.
Q In fact, I think you said, Doctor, if I'm not mistaken, that the transmission of gas that Exxon was concerned with was transmission within the Cockfield entirely -- not through the Jackson, but entirely



within the Cockfield, correct?
A Correct.
Q So there was no indication even of transmission of gas outside of the Cockfield formation through the Jackson by faults, correct?
A Not in the Exxon data.
Q Is there some other data where you found evidence of transmission through faults into upper stratum --
A Yes.
Q And what data is that?
A If you look at the 1936 AAPG article on the field -- this is Exhibit No. G, the fault map the application is based on -- and turn to Page -- if you turn to the second page of 737 at the bottom, the history of the field, "The site of the Conroe field, after gas seeps had been found on the Rhodes farm ... had attracted the attention of a local group of men. The field was --"
Q I'm sorry, I'm not hearing. You're reading into the book and I'm trying to hear what you're saying.
A "The site of the Conroe field, after gas seeps had been found on the Rhodes farm on the WS Rhodes survey," the field was first flagged because of



gas seeps on the surface.
Q We've discussed gas. I asked about oil, oil and water.
A And then if you go further in the report -- there's a reference later in the study that they believe that the conduit for the migration of this is through the faults.
Q That was in 1936. Am I understanding you correctly?
A Yes.
Q Tell me, is there production of oil or gas above the Jackson shale in the Conroe field?
A Yes.
Q So is it more likely or less likely that any gas seeps and/or any oil production seeping -- or oil coming to the surface is from stratum -- productive oil and gas stratum above the Jackson shale rather than below the Jackson shale?
A I would say it's more likely because its sourced deeper. So that is probably what sourced the shallow gas even above the Jackson. And then the additional problem you have in the field is -- is some of the blowouts they had in the past are believed to have charged up some of the shallow sands and -- because they were conduits for migration all the way

up through the Jackson up into the shallower sands or all the way up to the surface such as you have in the --
Q I'm talking about faults, Doctor. Are you talking about something different now? I'm talking about faults.
A About faults.
Q You're referring to artificial penetrations. We'll come to that, I promise.
A All right.
Q But let's talk about faults.
A All right. The APG article references permeable faults as being conduits for bringing gas specifically -- and I don't remember if it references oil and water -- up from the Cockfield up to the surface or in shallow sands above the Jackson.
Q How many millions of barrels of oil have been produced from the Conroe field?
A Several hundred million. I think it's -- maybe over 500.
Q And would that indicate to you that there are some good, solid confining layers in the Jackson -- excuse me, in the Conroe field?
A Yes.
Q Now, Doctor, you wanted to talk about



artificial penetration, so let's talk about them. Your discussion of blowouts and other happenings in the oil field, do you have any knowledge of where those events occurred?
A There was one that occurred -- it's referenced as occurring on the -- within the area of review in the A-672 J. McHorse survey --
Q Please tell me what you're looking at so I can refer to it.
A Well, if we look at any of your maps -- we can look at 1P or 1Q. And this is referenced, I believe, in the 1936 AAPG article. The blowout section starts on Page 772 of the article.
Q And which tract or survey were you referring to?
A It's this one right here (indicating).
Q Tell me the name again. I can't see that far.
A It's the A-672 J. McHorse -- M-c-H-o-r-s-e.
Q Okay. Now tell me if I'm wrong, Doctor, that a blowout, when one is talking about drilling an oil well, is the result of pressure, correct?
A Yes, that's one way to get it.
Q So when one does not take the proper precaution in drilling into a pressurized underground



stratum, the potential for a blowout occurs. Is that right?
A Yes.
Q So prior to drilling into that strata can we fairly conclude that it was under high pressure and confined?
A Yes.
Q So other than the artificial penetration -- and perhaps bad practices in drilling that well and describing that event -- or, I'm sorry, in that event -- that's not indicative of anything other than a solid confining layer, correct.
A Well, these are called -- these are leaky faults. They are not solid in the fact that they do leak --
Q Are you talking about faults again? Because I was now talking about artificial penetration. I assumed a blowout was associated with someone drilling in an oil field not taking proper precautions and pressure -- and hitting a reservoir under extreme pressure and that material coming to the surface and blowing out the well.
A Correct.
Q All right. So what does that have to do with faults?



A I've lost your train on your question. I guess --
Q Okay. We were talking about blowouts and artificial penetrations. Are you back to where we were discussing?
A Right.
Q All right. And a blowout is indicative of a solid confining layer until penetrated by an artificial penetration, correct?
A Correct.
Q How deep was the well that you've been discussing as a blowout on survey A-672?
A I believe it was completed in the upper Cockfield.
Q So that would again indicate that the Jackson shale -- at least in the area of that survey -- was a strong barrier to migration of hydrocarbons, correct?
A Correct.
Q Doctor, is there a difference between the movement of oil or gas in the subsurface versus water?
A Yes.
Q Could you explain that?
A Well, they have different buoyances; they have different densities.
Q So oil floats to the top. Is that correct?

A Correct.
Q And one would find the gas on top of the oil, correct?
A Correct.
Q So, therefore, they are under pressure and they move upwards. Is that correct?
A Correct.
Q As for gravity, does gravity operate in the subsurface?
A Yes.
Q And is it fair to say that fluids of different density would separate the same way they would in -- above the subsurface or on the surface? In other words, greater density fluids would go to the bottom and higher density fluids -- or, excuse me, lower density fluids would come to the top?
A Yes.
Q As compared to the brine that is in the lower Cockfield, do you have any knowledge of the density of the injectate?
A The injectate -- no.
Q That is proposed by --
A No, I don't.
Q -- TexCom?
Would you expect it to be different from



the brine?
A Yes.
Q In what way?
A Well, I presume it's not going to be exactly the same density. It won't have the same salinity.
Q Would you expect it to be more dense or less dense?
A I would predict that it would be less dense.
Q Okay.
A But again, I think the exact injectate has not been specified.
Q So you don't know, is that --
A I really don't know.
Q All right. Let's go to -- let's see here. I think you said in redirect examination that artificial penetrations are a big red flag or something on that order. Do you recall your answer to Mr. Walker's question?
A Yes.
Q All right. You have testified in other matters -- in fact, the only other disposal well matter where you've given testimony on the same points -- is that correct? -- that artificial penetrations or a large number of artificial penetrations around an injection well are a big red



flag and a permit should be not be granted. Is that correct?
A I won't agree with all of that.
Q Well, tell me which portions you agree with.
A They're a big red flag and they have to be examined closely to see if the artificial penetrations -- if you have the plugging records -- if they have been plugged properly, if they have been cased properly. The red flag doesn't mean that you're going to not be able to have an injection well in their vicinity, but they have to be characterized and analyzed, each one of them.
Q And you gave testimony in a case in Wise County where you said there were too many artificial penetrations around a proposed Class II injection well and, therefore, the permit should be denied. Is that correct?
A No, I would not accept that characterization.
Q Well, in any event, you testified on behalf of intervenors in that matter and were opposed -- that were opposed to the issuance of the Class II permit application.
A My testimony in that case was not that there were too many, but there were artificial penetrations within the area of review for which there was not



sufficient documentation and evidence of proper plugging.
Q Okay. Which is more important, the area of review or the cone of influence?
A They are both important.
Q Which one would you think would be more important for purposes of determining whether any of the artificial penetrations are likely to be transmissive of any injectate?
A The cone of influence, if it is modeled properly.
Q And you don't do any modeling, so I can't ask you questions about whether it was modeled properly in this case, correct?
A Well, we talked about this morning as far as the parameters --
Q Right, but -- I'm sorry. We also talked about you've never run a model, you've never submitted an application to TCEQ, and you have no earthly idea on whether it was modeled correctly in this matter other than you disagree with some of the input parameters?
A I will accept the first half of your statement, but the second half you can look at the parameters and you can have an earthly idea when you

look at the parameters that were used in the input model. And you don't have to have ever ran a model to know whether or not the input parameters are correct.
Q All right. And I understand your position on that. Have you reviewed Mr. Grant's testimony in this matter?
A Yes.
Q Do you agree with Mr. Grant's conclusions regarding how he modeled the reservoir?
A Yes.
Q Okay. Again, based on you agree with his input parameters as opposed to the applicant's input parameters?
A Yes.
Q Tell me the difference between the two models that were run by Mr. Grant and the ones that were run by Mr. Casey.
A In the application they're using a 10 square mile area for doing the reservoir modeling. Ten square miles, that's about, you know, a little bit bigger than a three-mile square. And that's too big a block to use when you look, potentially at the nature of faults. If you have faults that are nontransmissive faults, that's basically -- that's not a conservative calculation.



Q Do you know the difference between the two models, the one that Mr. Grant used and the one that Mr. Casey used?
A I believe they used different programs.
Q Okay. Do you know the difference between those two programs?
A No.
Q Your statement about 10 square miles being too big a block to use, I thought you testified earlier that the applicant modeled -- as you understood it -- as if there were no boundaries in the model.
A Well, he used a 10 square mile.
Q So there was -- the applicant did depict or did model a boundary condition as you describe, a 10 square mile boundary, correct?
A Yes.
Q So your disagreement with the applicant's model is that you think the 10 square miles is too big?
A Yes.
Q What model -- what square mileage would you model?
A You would have to -- in order to model it properly, you would have to go in and identify all the



faults in the area, determine which ones are nontransmissive and go ahead and constrain your modeling based upon that.
Q And that's what Mr. Grant said he did in his review of the modeling. He ran his own modeling calculation considering the fault that we've been discussing -- I think it's Item No. 30 or Fault No. 30 in the spreadsheet -- excuse me, in the exhibit we put together, Exhibit 74, correct?
A Correct.
Q And Mr. Grant said that he modeled that using a different program as a nontransmissive pressure barrier, correct?
A I believe that's right.
Q Do you agree with how Mr. Grant modeled the reservoir?
A I'll accept his modeling.
Q Okay. Is that to say, Doctor, that you agree with Mr. Grant's assessment of the faulting in the area and how he modeled the reservoir?
A He did not model as many -- he did not, I think, identify as many faults in the area as we did on our map.
Q In fact, he identified one other fault, which was a 50-foot offset fault and that he thought would



not make a difference in the model. Is that correct?
A Correct.
Q So as we discussed earlier, none of your faults -- not a single one -- shows an offset greater than 60 feet, and that's being generous, isn't it, Doctor?
A Correct.
Q So if Mr. Grant, who you have adopted his reservoir modeling, since you don't actually do that yourself, you accepted his reservoir modeling and he has dismissed a fault --
MR. WALKER: Your Honor, I have to object at this time. I've been quite patient. I believe all of this questioning is outside the scope of recross.
MR. RILEY: It's not at all. He testified about the transmissivity of faults and which faults were transmissive and which faults were not transmissive. He gave testimony about conduits and how the subsurface geology was complex and how it should be modeled.
JUDGE EGAN: I'm going to let you go -- overrule the objection, but --
MR. RILEY: I'm going to wrap up in 10 or 20 minutes.

JUDGE EGAN: Thank you.
MR. RILEY: Could I have the last question read back? I lost my train of thought.
(The last question was read as requested)
Q (By Mr. Riley) Mr. Grant found one other fault that he thought should have been considered in the area of review, correct, Doctor?
A Correct.
Q And he reviewed many of the same documents that you reviewed. Is that also correct?
A I don't have a list of what documents he reviewed.
Q All right. But in any event, he didn't think that the 50-foot offset or throw was a fault that needed to be considered in his modeling. Is that true?
A Correct.
Q Which faults of the ones that you've identified would you have incorporated into a model of the reservoir?
A Well, if I had been doing the application, as required by the application, having identified the faults, then I have to do a determination of whether or not the fault is transmissive. And I would --



Q Doctor, I'm going to ask you one more time: What faults would you have included in the modeling?
A And --
Q I'm not asking what you interpret TCEQ requirements to be or how you would do TCEQ business if you were in fact employed by the TCEQ. I'm asking you what faults you would have employed or used in the model?
A I do not know until I determine the transmissive or nontransmissive nature of the faults that are north of the northern-most fault that is -- that the applicant has identified.
Q So you would only consider -- if you consider additional faults, you would only consider the ones that are north and -- or west of the big red line across Exhibit 1P?
A If the -- if the big red line fault was considered a nontransmissive fault, then those would be the ones to concentrate on.
Q Doctor, if you know, which is more conservative in terms of determining the extent of the plume, the contaminant plume? Is it more conservative or less conservative to consider a fault transmissive?
A It would be -- well, if you're looking at your pressure buildup, then it's more conservative to



consider the fault nontransmissive.
Q I've asked you a different question, though, didn't I, Doctor?
A I'd have to read -- I have to hear the question again.
Q The question was regarding the contaminant plume, the constituent of concern to many of the people participating in this case, which is more conservative in modeling a reservoir, to consider a fault transmissive or nontransmissive, if you know?
A It would be to consider it nontransmissive.
Q Would be more conservative?
A Yes.
Q In terms of lateral extent of the plume?
A Well, yes, because by -- it's the pressure buildup you're interested in and the direction in which the fluid will move.
Q Now, let's go to -- pressure buildup relates to artificial penetrations, correct?
A It can relate to them.
Q Well, what else does it relate to?
A Well, your question -- the significance of artificial penetrations?
Q Yes.
A The significance of artificial penetrations



is they are a conduit if the pressure increases in the subsurface to move fluid up vertically.
Q Okay. In fact, you gave an answer to Mr. Walker's questions explaining that artificial -- regarding the study that Exxon did and the reason you're concerned about transmission in the Cockfield formation. You gave -- at least your first reason was Exxon was concerned that well bores -- the cement in wellbores had deteriorated?
A Correct.
Q So I assume from that that some part of your concern regarding transmission of injectate that would be part of the TexCom proposal would occur through artificial penetrations?
A It could potentially, yes.
Q The point I'm asking you, Doctor, is, if you know, the relationship between artificial penetrations and the pressure gradient calculated as the cone of influence?
A You have to decide whether or not you're going to assume that the artificial penetrations and at what pressure they would bleed off, or if they're open when you first start the injection.
Q And are you familiar with the assumptions made by Mr. Casey in his modeling regarding any

artificial penetrations in the cone of influence?
A I believe he regarded them -- that the -- the mud weight would be sufficient so that no fluid would move up vertically.
Q And did Mr. Grant agree with those calculations?
A I don't remember that.
Q Are there any particular artificial penetrations that you are concerned with in this case?
A Well, the applicant identifies over 200 of the artificial penetrations as having incomplete or no records on. So you have to be concerned with any of those if you have -- if you don't have the records, if you don't know what happened to the wellbores.
Q So even if I had an artificial penetration, say, in -- let's pick a -- in the A-688 survey, looks like BY Sitton -- that would be an artificial penetration of concern?
A The ones of concern would be one when you finished your reservoir modeling, and if it was based upon the proper parameters, then based upon that you would be especially concerned with artificial penetrations within that radius of influence.
Q Okay. The cone of influence, correct?
A Yes.



Q So it's fair -- even though you disagree perhaps with the way the applicant did the reservoir modeling -- it is fair to look at the artificial penetrations within the cone of influence, correct?
A Yes.
Q Of what relevance then is your discussion -- somewhat lengthy discussion -- of the water wells -- artificial penetration for water wells in the area of review?
A Well, as far as technical completeness and accuracy of the report, the applicant was charged with doing an inventory of any water wells within the area of review.
Q So it's simply a regulatory concern, not a technical concern from the perspective of water wells being drilled into the upper, middle or lower Cockfield?
A Correct.
Q So again it's from a regulatory perspective, one that you don't actually have experience with, as to whether the TCEQ required the four or five database reviews that you performed in order to come up with 126 water wells in the area of review?
A Correct.
Q And the database review that you did included



a TCEQ public water supply database, correct?
A Correct.
Q I think you would agree with me that the TCEQ has access to that database, does it not?
A Correct.
Q I think you'd agreed with me that the applicant used the Texas Water Development Board database for its plot of water wells in the area, correct?
A They used the -- the Water Board ground water database.
Q Groundwater database. And those are wells that have been assigned state identification numbers, correct?
A Correct.
Q The additional -- what database did you use -- the additional ones I've mentioned are three, correct?
A You mentioned --
Q I mentioned the TCEQ public water supply database. I mentioned the Texas Water Development Board groundwater database. And you used three additional databases to come up with your number of --
A We used two additional, the Lone Star Groundwater Conservation District database, and then



the fourth one was the Water Development Board reported drillers' log database.
Q Okay. Without disclosing any information regarding what you found, did you not also use -- I'm sorry, the P-2 database that relates to oil and gas exploration?
A Yes.
Q So the additional two databases for water wells that you used are a database where water well drillers feed that information into the Texas Water Development Board, correct?
A Correct.
Q Do you know of any quality control on that database or is it merely an onlline database available to water well drillers?
A They can submit their wells online. They can all still submit them in hard copy. But they are required to submit a driller's log on every well, and there is a penalty if they -- if they're caught not submitting --
Q Okay. And I think when we discussed this in your deposition, you did not know on what frequency, if any, that water well driller database migrates into the Texas Water Development Board database that assigns state well numbers, correct?

A Correct.
Q Similar questions regarding the Lone Star Groundwater Conservation District's database. Do you know how that database is compiled?
A It's -- I don't know the exact particulars, no.
Q Do you know how long the groundwater conservation district has maintained that database?
A No.
JUDGE EGAN: Anything further, Mr. Riley?
MR. RILEY: Just one second, Judge. I'm just checking my notes. I don't believe so.
No, thank you, Judge, I have no further questions.
JUDGE EGAN: All right. I just want to mention for the record that Texas -- TexCom Exhibit No. 74 was never offered.
MR. RILEY: Is that the -- I would like to offer that. I was going to actually use it with another witness on rebuttal, but at this time I'll offer it.
JUDGE EGAN: Any objection to TexCom Exhibit No. 74?
MR. WALKER: No.



JUDGE EGAN: There being none, it is admitted.
(TexCom Exhibit No. 74 admitted)
JUDGE EGAN: All right. Did the ED have any further questions?
MR. WILLIAMS: Yes, I have just three or four, Your Honor.
JUDGE EGAN: All right.
RECROSS EXAMINATION
BY MR. WILLIAMS:
Q Dr. Collier, back to your Exhibit 1G, and you mentioned under the history of the field gas seeps had been found on the Rhodes farm in the WS Rhodes survey?
JUDGE EGAN: Could you move the speaker closer to you?
MR. WILLIAMS: I'm sorry.
Q On Page 2 of 1G, you mentioned about the gas seeps had been found on the Rhodes farm in the WS Rhodes survey?
A Yes.
Q Is that WS Rhodes survey anywhere within the area of review for this application?
A I couldn't tell you that.
Q Is it true, Dr. Collier, that in the area of the Conroe oil feel there is also oil and gas



production from the Vicksburg and Frio formations?
A I don't know the answer to that. In the area or in the Conroe field?
Q Just anywhere in and around Montgomery County --
A Well, in the area, that would be yes.
Q Okay. And isn't the Vicksburg-Frio at a much shallower depth than the Cockfield?
A Yes.
Q Isn't it true that over time shallow gas deposits do seep to the surface -- over geologic time -- at a slow rate?
A Yes, it can.
Q And in your Exhibit 1J, the next-to-last page that showed the schematic cross sections indicating migration paths --
A Yes.
Q -- can a fault be transmissive of gas pressure but not transmissive of liquid pressure?
A Yes.
Q And how much -- how much pressure difference does there have to be for gas to migrate along a fault?
A I don't know.
MR. WILLIAMS: That's all, Your Honor.



Pass the witness.
JUDGE EGAN: Any further redirect?
MR. WALKER: Nothing further, Your Honor.
JUDGE EGAN: The witness maybe excused. Thank you.
WITNESS COLLIER: Thank you.
JUDGE EGAN: Do y'all want to take a break at this point or --
MR. WILLIAMS: A short one to put all our stuff back.
JUDGE EGAN: Okay.
MR. RILEY: I've got to get set up, but then I'm ready --
JUDGE EGAN: How about 10 minutes? We'll reconvene at a quarter to 3:00.
(Recess: 2:32 p.m. to 2:47 p.m.)
JUDGE EGAN: All right. We're going back on the record. It's about 10 to 3:00 on December 17th, 2007.
The court reporter mentioned to me that the -- there was some concerns about changes that were being made by the prefiled witnesses that were being made on the stand. So what I'd like each party to do after the hearing is send a letter to the court

reporter of what has been changed on the prefiled testimony for each person that sponsored that witness, and to copy everyone on those changes so that it's very clear. Any problems with that?

MR. RILEY: None at all.

JUDGE EGAN: Good. And you can do that probably -- preferably before the close -- the court reporter issues her final so she can incorporate it into the record. So y'all get with the court reporter and find out when she would like to -- or when they would like to receive that. That will be fine with me. And unless there's a problem, we'll accept y'all's dates as being fine to do that.

MR. FORSBERG: Your Honor?

JUDGE EGAN: Yes.

MR. FORSBERG: I would just say for the record, the -- I submitted redacted and corrected versions to the court reporter, and I believe it covers all of the changes that were made -- there's only one that was made on the stand, but that was included, and all the redactions were made.

JUDGE EGAN: All right. The only ones we're interested are the ones that are actually made on the stand, because the order -- objections we've already ruled on and we're pretty clear what that is.



So it's just the changes that were made by each witness on the stand.

MR. RILEY: And the only reason I interrupted is there were several changes we made, but we also applied a page which was marked as an exhibit. Is that satisfactory? Are we okay with that or would you like us to substitute --

JUDGE EGAN: If you've already made it your letter can simply indicate they were made on the record copy. And if anybody has any questions, they can consult the record copy.

MR. RILEY: Thank you, Your Honor.

JUDGE EGAN: Okay. I believe we're taking Mr. Grant next or is it Dr. Grant?

MR. GRANT: No, it's Mr. Grant.

JUDGE EGAN: Mr. Grant. Come on up. Since there's been a huge break, let me go ahead and have your sworn in again, although he is being offered for cross, I believe.

(Witness sworn) Your

JUDGE EGAN: Okay. And which one of you is going to be -- you had already passed and it was Mr. Hill.

MR. HILL: That's right.

JUDGE EGAN: Okay. Mr. Walker or



Ms. Stewart?

MR. WALKER: We have no questions, Your Honor.

JUDGE EGAN: Mr. Forsberg?

MR. FORSBERG: No questions, Your Honor.

JUDGE EGAN: Ms. Collins?

MS. COLLINS: I do have some questions, just a couple.

PRESENTATION ON BEHALF OF
LONE STAR GROUNDWATER CONSERVATION DISTRICT
(Continued)

PHILLIP R. GRANT,

having been duly sworn, testified as follows:

CROSS-EXAMINATION

BY MS. COLLINS:

Q Mr. Grant, I'm sorry if you can't see me. I'll try to lean in as much as possible.

I noticed on Page 5 of your prefiled testimony you stated that you'd prepared numerous feasibility and siting studies for clients relating to the potential construction of Class I injection wells for their facilities. Could you tell me what a feasibility study is?

A Typically, prior to preparing a Class I injection well permit application, a client will ask



that a feasibility study -- both geologically, engineering and reservoir study -- be performed to determine whether the site is an applicable and acceptable site to put a Class -- or to permit a Class I injection well. And parameters such as geology reservoir mechanics, and artificial penetrations will be typically included in that feasibility analysis.

Q Okay. So the feasibility studies that you've done are very much linked to geology and location. Is that correct?

A Correct.

Q Have you done feasibility studies for any other type of disposal facility?

A I believe in the distant past in my career I've done them related to landfills.

Q Okay. Are those feasibility studies that you've done with regard to landfills very similar in that they involve whether the location and the geology is suitable for the proposed activity?

A Yes, they are, but they're different in that they deal primarily with surface features and surface and near surface geology instead of deep geology.

Q Right. Okay. Are they at all different other than the surface geology versus subsurface geology?

A There's no reservoir mechanics with a surface facility.
Q Okay.
A That's the main difference.
Q Have you ever performed a feasibility study that actually compared one disposal method to another?
A Yes.
Q Could you describe what those studies involved?
A It was primarily looking at whether a high total dissolved solids wastestream would be more amenable to deep well injection versus evaporation, incineration, or RO concentration in off-site discharge.
Q What factors did you use in making that comparison, if you can recall?
A The net amount of resulting waste that would be left in the biosphere or on the surface, the economic cost for the various alternatives and, in a very limited way, the air emissions involved.
Q So is it fair to say in the feasibility studies that you've done comparing waste disposal methods, you weren't just looking at -- well, it sounds like you were looking at economic feasibility, perhaps even practicality. Is that correct?



A That is correct.
Q Okay. Was it done for a potential Class 1 waste -- nonhazardous waste disposal facility?
A Yes, it was.
Q Okay. And you were doing that for the applicant in that matter?
A The potential applicant.
Q Potential applicant. So in your mind, does feasibility involve -- does it involve the degree of environmental protection as well as economics and just the practicality of a location, et cetera?
A It involves all of those. It's on a very preliminary level, which is somewhat the definition of feasibility study. And the final yes/no decisions are left to the client. Recommendations can be given and potential disadvantages of each disposal technique can be noted, but the final decision obviously is up to the client.
Q Okay. So you're giving them a list of options, basically, based on all the factors?
A Correct.
Q Okay. I think we've talked before about, generally, your opinion that injection is a form of wastewater disposal is a safe method, correct?
A In the right circumstances, yes.



Q In the right circumstances. As a general matter, what factors would you consider in determining whether one wastewater disposal method is better than another?
A Which is the most protective of the environment.
Q And that involves geology and everything we've been talking about, correct?
A Yes, a lot of different aspects.
Q Okay. Assuming -- so I'm -- I think I'm understanding you to say that you can't tell me today that overall injection is the safest form of disposal. Is that correct?
A For aqueous liquid waste in the Gulf Coast, it is one of the safer methods of wastewater disposal.
Q Okay. Tell me why you think that.
A It does not take a wastestream. And if it still contains constituents that could pose a danger to human health or the environment, it puts them away, so to speak, into the deep subsurface where they are no longer in contact with the environment --
Q Assuming --
A -- the surface environment.
Q I'm sorry, state that last part again?
A They are not -- they are no longer in contact



with the surface environment.
Q Okay. So assuming everything goes well and as predicted, then you would prefer injection over any other form of disposal. Is that correct?
A For certain wastes.
Q Okay.
A Primarily liquid wastewaters with low concentrations of hazardous constituents.
JUDGE EGAN: Could you speak up just a little bit?
WITNESS GRANT: Yes, ma'am.
Q (By Ms. Collins) And do you understand the wastestream in this case to be one of the preferential wastestreams that you just mentioned?
A It is a -- at least the wastestream as described in the TexCom application -- appears to have low levels of chemical constituents below the hazardous level, which, if injected into an appropriate reservoir, would be a good method of disposal.
Q Okay. So the -- are you saying that you can actually tell from the amount of information in the application that this type of wastestream would be among those that you would consider appropriate for Gulf Coast geology?

A Based upon the data that is supplied in the TexCom application, no specific concentrations of the various constituents are given. However, based upon the general classifications of wastes and the fact that it is being applied for as a nonhazardous wastewater injection well, it would appear, based upon what they have supplied in their application, to be an appropriate type of wastestream for deep well injection.

MS. COLLINS: Okay. Thank you. No further questions.

JUDGE EGAN: All right. Would it be Mr. Lee or Mr. Riley?

MR. RILEY: Me.

JUDGE EGAN: Okay, Mr. Riley.

CROSS-EXAMINATION

BY MR. RILEY:

Q Good afternoon, Mr. Grant.

A Good afternoon.

Q Mr. Grant, we've talked about this application previously in deposition. Is that correct?

A That is correct.

Q And I want to pick up to some degree where Ms. Collins left off. Is it fair to say that a number



of the clients you represent are engaged in the safe process of liquid waste disposal into injection wells? Is that correct?

A That is correct.

Q And I don't mean to oversimplify your testimony in this matter, but I think I can sum it up -- I think you do in fact sum it up in your testimony -- that you disagree with certain assumptions and parameters utilized by Mr. Casey in his reservoir modeling. Is that correct?

A That is correct.

Q But otherwise you do not see the injection zone -- and I'm not speaking generally. I'm talking particularly the injection zone or the Jackson shale or the faults that have been described by other witnesses as disqualifying from an injection well perspective. Is that a fair characterization?

A Generally that is a fair characterization.

Q Let me go a little more into the specifics. But I do want to at least get clear on the record that you do not see the TexCom site and its proximity to the Conroe oil field as a necessary -- as necessarily disqualifying TexCom from having an environmentally-safe operation. Is that correct?

A That is correct.



Q The number of applications that you've worked on for Class I injection wells, if I remember your testimony correctly, is 20. Is that correct -- or approximately 20?

A I think that's a pretty good number. It may vary -- for new well permit applications --

Q It's on Page 4 of your testimony. And I don't -- I wasn't trying to make a point of it other than it does seem as though you've had a number of applications that you've been involved with before the TCEQ for the permitting of underground injection of nonhazardous industrial waste through Class I injection wells, and I think your answer is at least 20?

A That would be correct.

Q All right. Have you permitted any Class I injection wells in the Conroe area or Montgomery County?

A No, I have not.

Q Let's talk a little bit about -- before we get into some other specifics -- the types of models that were utilized in the reservoir modeling as between the applicant and the model you used. We talked about this in your deposition, but as I understand it, you used a particular model that is



used by the TCEQ or offered to applicants by the TCEQ referred to as PRESS2. Is that correct?

A That is correct.

Q All right. And the model that was utilized by Mr. Casey and, ultimately, submitted with the application, is -- I've heard it referred to as BOAST98 -- I think that's the way we have it in the prefiled testimony -- or BOAST98. I think it's BOAST98. Is that correct?

A That is correct.

Q Now, if I understood your deposition testimony, the PRESS2 modeling is based on algebraic equations, correct?

A Yes, it's an analytical solution to pressure increase.

Q And the equations utilized in the PRESS2 modeling are fundamentally algebraic equations. Is that correct?

A That is correct.

Q And the BOAST98 modeling that was utilized by the applicant, I think you acknowledged in your deposition that it is a more complex model that takes into consideration different parameters than the PRESS2 model, and is based on differential equations, correct?

A It's a finite difference model and uses similar input parameters; however, allows for certain reservoir heterogeneities which are additional reservoir descriptors beyond which the PRESS2 model allows.
Q All right. And I think I asked you, as best I could articulate it, in your deposition whether you thought it was more likely or less likely -- the BOAST98 model was more likely or less likely to predict the real life or real world conditions. Do you remember those questions?
A I do remember those questions, yes.
Q Am I correct in remembering your answer was yes; that because it takes into account different -- differing parameters, that it is more likely to reproduce real world conditions?
A I believe my answer was that it is more likely to produce a descriptor of flow and transport; however, related to pressure increases, the differences between the two, assuming similar inputs were put in, would be very minimal.
Q I appreciate that clarification. That's my recollection, too. But as it pertains then to flow and transport or transfer of the waste -- transport of the waste plume, you would expect BOAST98 to be more



accurate predicting?
A Yes, the PRESS2 model does not predict flow and transport of the waste.
Q Okay. In your experience then in utilizing PRESS2 with the TCEQ, how do you account for flow and transport in the permit applications you've worked on?
A For Class I nonhazardous injection well permit applications, flow and transport is not solved through PRESS2 or through BOAST98. It is presented as an analytical solution in a formula separate from PRESS2.
Q Okay. As between that formula separate from PRESS2 and that analytical solution you described and the BOAST98 model, which would you think is more predictive of real world conditions?
A The BOAST98 model is more predictive of the plume front at the end of operations and subsequent to that. However, that was not used to determine the plume front in BOAST98. The same analytical solution was provided by the TexCom application as I would do.
Q Okay. I'm sorry, I misunderstood -- I didn't hear the last part of what you said.
A The BOAST98 model was not used -- was used only to predict pressure increase within the injection reservoir. The determination of the plume front for



the TexCom application used an analytical solution similar to one I would use.
Q And you have no disagreement with that calculation in the -- in TexCom's application. Is that correct?
A The calculation of the plume front?
Q Yes, sir.
A Not that I can recall.
Q It's certainly not identified in your prefiled testimony to my recollection.
A That is correct.
Q So we are then back to discussing the pressure -- pressure front, is that --
A We're essentially back to discussing the pressure increase within the injection reservoir and the resulting cone of influence, depending upon which input parameters one uses.
Q All right. Now, you have -- using the PRESS2 model, you have modeled the reservoir using 81 millidarcies as your permeability. Is that the right term?
A That is correct.
Q And you have input into the model or into your solution using PRESS2 that the fault to the south, approximately 4400 feet from WDW-315, is



nontransmissive. Is that correct?
A In one of my scenarios I modeled it as nontransmissive. In the other I modeled is as transparent (sic).
Q Okay. So you did it both ways, so to speak?
A Correct.
Q So the difference then in your first modeling scenario was to change the permeability exclusively, correct?
A The attempt in both models was to mimic the BOAST98 model with the exception of the permeability and the no-flow boundaries.
Q Okay. Let me try it a different way. As I understand it, in the PRESS2 modeling, one of the input parameters is the permeability, correct?
A That is correct.
Q And that is also true in the BOAST98 modeling, correct?
A That is correct.
Q In the BOAST98 modeling that Mr. Casey performed, the permeability was assumed or predicted to be 500 millidarcies, correct?
A That is correct.
Q And in the PRESS2 modeling that you performed, the permeability in all your scenarios was

assumed to be 81 millidarcies, correct?
A That is correct.
Q In two of the scenarios you ran for -- in the PRESS2 model, you assumed the fault to the south, the 4400-feet-away fault, to be transmissive, correct?
A In one of the scenarios, not two of --
Q I'm sorry, I misunderstood. Okay. How many total scenarios --
A Correct.
Q I'm sorry. I misspoke. I apologize. So in the first scenario you did, you assumed 81 millidarcies permeability and the fault to be transmissive, correct?
A That is correct.
Q And your conclusion was that the cone of influence would not be the 750 feet that has been clarified in this hearing that Mr. Casey calculated, it would be some 3,000 feet. Is that correct?
A I would need to look at my model outputs, but I believe it was somewhere in that range of distance.
Q Would you mind taking a moment and looking through it if you have it before you and confirming my recollection?
A The distance would be 3170 feet.
Q So your calculation that would most directly



correlate with Mr. Casey's calculation is a cone of influence of 31 -- I'm sorry, 31 --
A Yes, a radius of 3170 feet.
Q And that would correlate to Mr. Casey's calculation of a radius of 750 feet, correct?
A I'm not exactly sure what you mean by "correlation" because we didn't use the same input parameters.
Q I understand. And I'm -- you use -- the only difference in that input scenario -- your input scenario and Mr. Casey's input scenario, other than the type of model you ran, which you said were equivalent -- was the permeability that Mr. Casey used was 500 millidarcies and the permeability you used was 81 millidargies?
A That's not the only difference between the two --
Q That's what I'm trying to understand, so please explain.
A The other differences in the BOAST98 model, when the fault was reached some 4400 feet to the south, the model thickness to the south expanded to some 401 feet to the south of that fault as generated or as constructed within the BOAST model.
Q Okay. And that, according to Mr. Casey, is



where the sands of the lower Cockfield would -- if the fault is transmissive as Mr. Casey modeled it -- would expand, so to speak, or the middle Cockfield would become available. Is that what you understood from the testimony in this case?
A It was not in the TexCom application that specific delineation; however, I believe I heard Mr. Casey note that fact in his testimony.
Q Okay. So in Mr. Casey's model, at 4400 feet additional sand -- assuming the fault to be transmissive between the lower Cockfield and the middle Cockfield -- becomes available, and you noted that as a difference in -- from your PRESS2 modeling, correct?
A Yes, that is an additional difference.
Q Okay. Are there other differences?
A Not that can be compared directly between the two models.
Q Okay. Let's talk about the width of the injection interval. Did you use 145 feet?
A I did.
Q So you didn't limit the injection interval to the 90 or so feet that is currently perforated. Is that correct?
A No, the purpose of my running these two



models was to make as close a comparison with the BOAST model as I could using similar input parameters, as similar as I could get, and just varying one input parameter, that being permeability.
Q Your intention --
A And I'm sorry -- and also whether the fault was trans -- was a fault -- a pressure barrier or not.
Q Okay. So at least your attempt was to vary -- in your first scenario, which did not consider the fault 4400 feet away as nontransmissive -- Are you with me so far, the 3,173 feet that you calculated as the cone of influence?
A 3,170 feet, yes.
Q 170. I'm sorry. That model run, so to speak, in the PRESS2 model -- your intention was to vary only one input and that was permeability, correct?
A That was my intention, yes. There were small -- the things that I could -- that I could match up -- structural dip in the BOAST model is not inputable -- to use probably the incorrect term -- but it cannot be input into the PRESS2 model. But the dip is fairly slight, so it should make very little difference as far as the pressure increase goes.
Q Okay. So that -- I mean, I think I

understand that the PRESS2 model simply doesn't have considered in it input parameters that go into BOAST98. Is that correct?

A There are some input parameters in BOAST98 that cannot be put into the PRESS2 model because of the heterogeneities in the reservoir, which can be added into the (inaudible)

THE REPORTER: I'm sorry, I didn't hear the last --

WITNESS GRANT: The BOAST98 model. Those heterogeneities essentially being in the BOAST98 model is -- it was modeled, the slight structural dip and the change across the fault to a thicker -- to a greater thickness to the south.

Q (By Mr. Riley) Is it accurate to say the PRESS2 model considers the injection interval homogenous?

A Could you be more clear about homogenous numbers?

Q Well, you said that the BOAST98 accounts for more heterogeneity. Is that correct?

A Correct.

Q So I would assume then, as sort of a corollary to that statement, that the PRESS2 model would look at the reservoir as being more homogenous.



A Yes, more geologically homogenous in input parameters, yes, if you want to define it that way.

Q All right.

JUDGE EGAN: Mr. Grant, could you speak up just a little bit or move the mic a little closer?

WITNESS GRANT: Is that better?

JUDGE EGAN: Yes. Thank you.

Q (By Mr. Riley) All right. With all those considerations that you've described and we've discussed, your objective -- at least in your first model run and the PRESS2 model -- was to see what a change in permeability did in terms of defining the cone of influence, correct?

A That is correct.

Q As I understand it, Mr. Grant, the TCEQ UIC program addresses permeability post permit -- in addition to pre-permit, there's a requirement post permit regarding permeability. Could you describe that to the ALJs?

A Typically, when a new well is drilled, a completion report is turned in to the TCEQ. And in that completion report is a Fall-off test which has calculated or determined an average permeability for the perforated interval. And that average permeability for the perforated interval is reviewed



by the TCEQ prior to allowing injection to begin to determine whether the Fall-off test derived permeability is conservative related to the calculation of the cone of influence as presented and originally in the application.

Q So in this application the fall -- excuse me, the permeability represented by the applicant, the average permeability, is 500 millidarcies, correct?

A As represented by the applicant at -- and the applicant's model is represented as 500 millidarcies.

Q Is it your understanding that before any waste could be injected the well would have to be perforated as the applicant has described in its application, and a Fall-off test -- a different Fall-off test would have to be conducted to confirm that the 500-millidarcie assumption was conservative?

A If the applicant does perforate -- well, let me rephrase that. This is, I guess, a unique case in that the well was drilled 10 years ago. The permit application has already been -- or the permit -- the completion report has already been turned in and the Fall-off test has already been performed, and the results of that Fall-off test have been submitted. What I am not sure about is whether -- although the applicant states that they will perforate an



additional 45 feet of the lower Cockfield prior to injection, that there is any vehicle regulatorily required that that be done. That is the concern that I have.

Q Now, are you familiar with the general requirement in TCEQ rules that -- or, excuse me, representations in permit applications are enforceable?

A Yes, I am.

Q And would you consider the applicant's representation that it will perforate 145 feet in the existing well to be enforceable under that general provision?

A I don't know. I don't know the answer to that.

Q Would you consider the -- could this well -- assuming we weren't all here in this room and things had been different under the original permit -- well, let me state it differently.

Could the applicant inject waste if this permit were granted without any further regulatory process?

A Without --

Q Without a new completion report, a confirmation of a Fall-off test and an authorization

by the agency to accept waste, could all -- would none of that have to happen if this permit application is granted?

A I believe that's a possibility. I don't think it's a possibility with the three undrilled permitted wells. But because of the unique situation with this well, I'm not sure that any other, quote, unquote, safety checks would necessarily have to be signed off on by the TCEQ before injection was allowed.

Q All right. Could your uncertainty be resolved by a condition in the permit that said that the applicant must adhere to its representations -- whether I think that's necessary or not or TCEQ thinks it's necessary or not -- if there were a condition in the permit that said the applicant must perforate at 145 feet at a minimum of the injection interval and do a Fall-off test and follow all of the requirements as if this were a brand new well, would that relieve your concern regarding the assumption made in the application about 500 millidarcies?

A If the applicant were -- or if the TCEQ were to include in the final draft permit that the applicant perforate the additional 45 feet as noted in the application, and that an additional -- a new



Fall-off test be performed over that newly expanded perforated interval, and that the results of that Fall-off test be reviewed to be conservative or if an enlarged cone of influence were determined to be found based upon that permeability, and any additional artificial penetrations within that enlarged cone of influence were to be researched and found to be nonendangering as far as movement into a USDW, then I would feel a lot better about that, assuming the issue of a nontransfer -- or a pressure boundary be addressed in the modeling, I do believe that it would be possible to determine if that pressure boundary is there and running a new Fall-off test.

Q Let's explore that, because that's where I want to go next. But I recognize your answer was very precise and I do appreciate it. But I would like to call your attention to Page No. 6 of the draft permit, and Condition G.

A Is that in -- where would that be found in --

Q It's TexCom Exhibit 27, Page 6 of 24 in Volume 11.

A Exhibit --

Q I'm sorry, it's Exhibit 27, Page 6 of 24.

A In Volume 11 there is no exhibit --

Q Well, I was told Volume 11. Let me confer



with my colleague.

A The tabs are upside down.

(Laughter)

Q It's a lot of paper. Take your time.

A Page what?

Q Page 6 of 24.

A I have Page 6.

Q You see "Special Conditions G," letter G?

A Yes, I see that.

Q Okay. Does not this condition address your concern regarding the permittee's obligations with respect to WDW 315, which will become WDW 410?

A It does not address issues related to specifically performing another Fall-off test.

Q If we added to the special condition that this well would follow the path of all other wells that are recompleted in different intervals that the regulatory process that's in TCEQ rules would be required just as it would for any other well, would that address your concern?

A Well, the rules for recompleting into another interval are not as complete as the requirements for a new well as far as confirming reservoir conditions.

Q Fair enough. But if it were to say that this would be treated as if it were a new well after



recompletion as described in the application's -- detailed in that condition, would that address your concern?

A If the specific issues, as I previously stated, related to additional perforations, Fall-off tests, recalculation of cone of influence, reevaluation of artificial penetrations within a revised cone of influence, and potential changes to the operating parameters based upon the results of that remodeling and determination of any artificial penetration issues, were specifically addressed or noted in here, then I would feel a lot -- I would feel like that the concerns that I have have been -- are being addressed.

Q All right. So that would take care of the Item No. 1 that we were discussing at a minimum, which would be the -- I don't mean to be coy or cute about it -- but who is correct about the permeability or the average permeability in the injection interval, 81 millidarcies versus 500, that would be addressed in that process, correct?

A I believe the Fall-off test that would be subsequently performed after reperforating would address the issue of what the average permeability of the injection reservoir is. That is correct.

Q All right. And that would resolve the difference you have with the application based on a prior Fall-off test in a different interval; that would be sorted out by a subsequent Fall-off test on a new perforation if indeed that process was followed, correct?
A Yeah, that would -- that would answer the question related to the permeability of the reservoir and -- but not necessarily the issue of a no-flow boundary.
Q Okay. Let's talk about the no-flow boundary. There was some discussion -- I think you've been here for the entire hearing. If I'm mistaken, please correct me.
A No, that is correct.
Q There was some discussion of whether a Fall-off test would show a pressure boundary. And, at least in Mr. Casey's testimony, indeed a Fall-off test does indicate whether there is a pressure boundary around the well. Is that correct?
A Out to the radius of investigation of the Fall-off test, yes, it would be an indicator as to whether there was a no-flow boundary, an enhanced permeability or enhanced thickness boundary, and/or potentially a partially penetrating reservoir.



Q So again, out to the radius of investigation, which in an earlier Fall-off test was 1500 feet, correct?
A I believe that is correct.
Q The Fall-off test is useful to determine -- for determining whether there are any pressure boundaries, which could include a greater transmissivity or greater permeability, or a nontransmissive fault or other barrier, correct?
A It would be -- Fall-off tests within the radius of investigation can provide data which, upon analysis and review of both the semi log and the log curves -- which are essentially certain analyzable drafts of a Fall-off test -- can pick up no-flow boundaries which would be potentially either a pinch-out or a laterally-sealing fault -- can, if properly performed -- again, I should make that a caveat -- also determine if there's permeability changes at some position out in the reservoir as well as determining if there is a leaky aquifer response within the reservoir.
Q Is there any question in your mind, Mr. Grant, that for the three wells that are not drilled, the same procedure would have to be followed under TCEQ rules? I mean, I know you have some



uncertainty regarding the well that's already drilled and what the requirements would be, but what about the other three wells?
A It is my belief that the other three undrilled wells would have to meet the standards of completion as set out in the TCEQ rules for demonstrating those specific issues.
Q So any uncertainty you have regarding additional Fall-off tests and pre-approval and, I guess, review of permeability and cone of influence, that attaches only to the existing well, correct?
A I believe that is correct.
Q Mr. Grant, as I understand it -- and please correct me if I'm wrong -- that the modeling associated with a Class I well that we're discussing, whether it be the PRESS2 or the BOAST98, that those models and the TCEQ requirements regarding use of those models impose very conservative assumptions. Do you agree with that?
A Yes, I agree with that.
Q And in your experience in dealing with Class I wells, have you found after completion of a well, and conducting a Fall-off test that TCEQ has been lax in its enforcement of its own requirements?
A Not with the permit applications that I have



submitted and the completion reports that I have turned in to the TCEQ. But I can only speak for my own applications.
Q That's all I'm asking you to do, sir.
How about the monitoring and reporting requirements for UIC wells in general, Class I wells, are they rigorous in your opinion?
A I believe they are.
Q Could you describe what they are, what the frequency is for additional information being submitted to the TCEQ and what the review process is?
A Are we talking about after the well is online and injecting?
Q Yes, let's talk about that. What is the process, in your experience in dealing with the TCEQ, after a well is online and injecting waste?
A The annulus -- or annular system must be monitored continuously for any potential loss of annulus pressure, which would be an indicator either of casing or a tubing leak above the packer. Typically, specific gravity, pH, maximum wellhead pressure are also monitored either continuously or on a regular basis.
Annual waste treatment analysis for wastestreams that do not vary are required to be

turned in with an annual report. And yearly mechanical integrity testing is required of the well, which involves both a radioactive tracer test, an annulus pressure test and an ambient pressure monitoring of the reservoir, which typically includes a Fall-off test. And that's the primary monitoring that goes on with an injection well -- Class I injection well.

Q And I'm not an expert on these requirements as you are, sir, but in my reading there was a requirement that if the reservoir pressure was not responding as predicted, based on these annual reviews and reports then additional conditions could be placed on the well, including shutting the well in until the pressure comes back in line. Is that your understanding?

A Not really. My understanding is that if the -- if the maximum injection wellhead pressure is exceeded above that which is permitted, the well has to be shut in until -- well, it cannot be exceeded. If it exceeds it, the well has to be shut in. And then it can be turned back online once the pressure decreases below that maximum, but it is not allowed to be exceeded during operation.

Q I'm sorry, I misunderstood that requirement.



The requirement then for Fall-off tests after the initial Fall-off tests, could you describe those in more detail?

A Typically, with the mechanical integrity testing report, which gives the result of the annulus pressure test, and the radioactive tracer test, the results of the Fall-off test -- if it's performed at the same time, and it's not required it be performed at the same time but is typically included with that report -- indicating what the calculated permeability of that Fall-off test is.

Q Well, I'm going to call your attention again to the same exhibit we were working with a moment ago, Page 4 of 24. This time I'm looking at Section 8 -- Roman Numeral VIII, Monitoring Tests Requirements, Subsection (c). Do you find that?

A Yes, I do.

Q Could you read it into the record, please?

A "The pressure buildup in the injection zone shall be monitored annually, including, at a minimum, a shut down of the well for a sufficient time to conduct a valid observation of the pressure Fall-off curve."

Q Yeah, that's where I misunderstood the shut down requirement. But the well can be shut down while



this annual testing or annual Fall-off testing is done. Is that your understanding?

A The well has to be shut in for the Fall-off testing. That's part of the Fall-off testing.

Q And there is an annual requirement to conduct a Fall-off test based on the provision we just -- you just read. Is that correct?

A That is correct.

Q And if the results of that Fall-off test showed a difference in the conservative assumptions that were made in the application, what would be the process of the TCEQ in addressing the difference in the Fall-off test?

A I do not believe there is a vehicle for the TCEQ to do anything about that after the permit is issued as long as the maximum injection pressure -- wellhead surface injection pressure is not exceeded until the time of permit renewal comes up, which is generally on a ten-year cycle.

At that point the accumulated Fall-off test results would be presented in a permit renewal application where the historical Fall-off tests would be incorporated into a new model, and a demonstration would be required that that model is conservative based upon the historical Fall-off tests over the life



of the well.

Q I'm sure you haven't had much experience in TCEQ enforcement, but is it your testimony that if a Fall-off test -- an annual Fall-off test indicated that there was a greater cone of influence or that there was an issue of endangerment that the TCEQ could not address it until the ten-year renewal?

A Typically the cone of influence is not recalculated with each year's Fall-off test analysis. Just the permeability as -- or flow capacity is presented in that Fall-off test report. I do not believe that the TCEQ provides enforcement action related to an anomalous Fall-off test permeability, but provides enforcement action related to exceeding the maximum wellhead injection pressure.

Q I understand. The cone of influence is calculated on what timeline? My understanding -- do I understand correctly that the cone of influence contemplates 30 years of injection?

A Yes, the -- the application guidelines from the TCEQ require that you model it out to the projected life of the well, which the TCEQ has stated -- not arbitrarily -- but has determined to be a number to use of 30 years.

Q So if I understand correctly, the distances

that are calculated as part of the PRESS2 or BOAST98 modeling -- and you've given those earlier in your testimony this afternoon -- those are distances of pressure gradient, so to speak, after 30 years of injection at maximum rates. Is that correct?

A For the pressure cone of influence?

Q Yes, sir.

A Yes, for 30 years. The waste plumes are, I believe, 1, 10, and 30 years.

Q And I'm talking about pressure right now because we'll go back to waste plume if necessary. But for the pressure calculation, which is the issue of concern for artificial penetrations, correct --

A Correct.

Q So you're looking at -- when we talk in terms of 750 feet or 3,170 feet, we're talking about where that pressure will be after 30 years of injection, correct?

A Where the cone of influence/endangerment pressure, which in this case I believe is 421-psi pressure increase, where that front lies within the area of review after 30 years as presented in the pressure model.

Q Okay. And you don't have any disagreement with the calculation of the 421 psi. Is that correct?



A No, I do not.

Q And, I'm sorry, because sometimes it's just not -- doesn't penetrate. Maybe it's late in the afternoon. But when I begin -- or say I was to begin injecting into an injection well as proposed in the TexCom application, it's not as though on the first day I inject, the pressure is felt 750 feet out from the wellbore, correct?

A Well, there will be -- even with a low permeability or a high permeability reservoir, there will be a pressure effect or what I would call a pressure transient that will project out a fairly substantial distance within a fairly short period of time. Not that that is going to be a 421-psi pressure increase, but the reservoir permeability or the interconnectedness of the pore space will transmit that pressure out fairly quickly to some distance.

Q And, I'm sorry, because I keep trying to think of things in simple terms, but eventually then that 421-psi mark moves out over 30 years to the boundary of the cone of influence as defined by the two models that were run in this case?

A Yeah, that cone of influence is a moving front -- if you want to put it that way -- in that after 30 years, depending upon how you model it, it



will be at a certain distance. But in the intervening years between zero and 30 that endangerment pressure or cone of influence gradually expands out to that distance.

Q So again, in my simple terms, year one it's a certain distance from the wellbore; year two -- the 421 mark I'm going with -- year two is a little father out, so on and so on, until you hit year 30 and that's where this distance is defined?

A And in the permit application, yes, that is correct.

Q Okay. Let's talk about the fault 4400 feet to the southeast of the well. You're of the opinion that the fault is not transmissive -- nontransmissive, correct?

A I'm of the opinion it is nontransmissive vertically and laterally.

Q Okay. So do you have in front of you TexCom Exhibit 72?

(Discussion off the record)

MR. RILEY: We can substitute one into the record. It wasn't marked or anything. It does seem as though maybe Dr. Collier gathered it with his belongings.

JUDGE EGAN: In that case, since we may



be substituting another copy for TexCom Exhibit No. 72, Mr. Gershon, feel free to loan him your copy in the interim, if that's agreeable with everyone. If it is, thank you.

MR. RILEY: It certainly is with us.

A There's to exhibit number on this.

Q (By Mr. Riley) I understand. That's because the original has been -- has left the room it appears.

JUDGE EGAN: One of the witnesses inadvertently picked it up --

JUDGE WALSTON: You have the right document.

WITNESS GRANT: This is the correct document?

JUDGE EGAN: Yes.

Q (By Mr. Riley) Obviously, Mr. Grant, this is not drawn to scale, but let's talk about the -- what is depicted on this diagram as a fault to the right side of the diagram. Do you see that?

A Yes, I do.

Q And in rough terms, would it correspond to your understanding of the geology around the fault that we've -- you've talked about just a moment ago, the 4400-foot away fault that you say is nontransmissive?

A If this is the fault that they -- as drawn on here, if that's the 4400-foot fault, I do not know whether it extends up above the Jackson shale or not so I don't know if it's a true depiction of the fault at shallower horizons, whether it extends higher or not. But I do believe it does cut all of the Cockfield, upper, middle and lower.

Q Okay. And with that clarification or qualification, can we work with this diagram in discussing the operation of that fault in the Cockfield formation?

A We can. I believe the lower Cockfield is about 300-plus feet, and to my recollection the offset on this fault is somewhere between -- somewhere around 150 to 200 feet. So if I were drawing this, I would show more of an offset here than what appears to be potentially about 70 feet of throw on the fault.

Q All right. That's fair enough.

A But realizing it's not to scale, however .

Q Yes, and that's -- I don't want to bind you to any distances or make any -- have you agree to something that clearly I don't intend. It's simply a diagram of a fault showing in rough terms the upper Cockfield, a shale layer, the middle Cockfield, a shale layer and a lower Cockfield without any



relationship to actual distances or even relative thicknesses to those layers. Is that fair?

A That is correct -- or fair, yes.

Q All right. Now, again, with the other qualification you had is you don't have any information on whether the fault extends above the Jackson shale, let's talk about how the fault would be nontransmissive in your opinion. Can you explain how you believe that a fault -- again, in gross terms -- that's depicted in this diagram would be nontransmissive as between the Cockfield sand?

A Additional detail within the middle and lower Cockfield strata would show that probably close to 50 percent of each one of those are -- consist of shale strata and the other 50 percent sand strata or, in the lower Cockfield, approximately 145 feet of sand to a total thickness of 300-something thickness. And these sands and shales would be interbedded both in the lower and middle Cockfield, meaning alternating sand and shale strata as you move vertically up or down the section.

My belief is this greater-than-50 percent or approximately 50 percent shale to sand ratio allows two mechanisms of sealing along that fault, the first being a sand-to-shale



juxtaposition across the fault; the second being what's called shale smearing of the fault plain, both of those, which provide a shale low permeability barrier to both fluid movement laterally and vertically and pressure movement laterally and vertically.

Q Okay. So if I understood what you said correctly, the -- the shale content -- and I'm not trying to pin you down on shale content -- when this fault occurred, the shale portion would have smeared across the fault line. Is that your -- am I correct in interpreting what you said?

A The -- yeah, it's not a one -- I don't believe it would have been on any of these a one-time event where the 150-foot of throw would have happened instantaneously. But over geologic time, potentially millions of years, this total amount of throw or offset along the fault would have occurred. And along that actual fault plain or -- it's sometimes called a gouge zone -- it's a geologic term -- that the shales or clays, because of their more putty-type constitution, would have a tendency to be smeared along that fault plain and provide a -- essentially a seal, a shale-smear type of a seal.

Q Okay. Would that same theory apply to faults



of a lesser throw or offset?

A Yes, it potentially could.

Q The sealing feature you describe seems to be somewhat at odds with Dr. Collier's testimony that all faults are transmissive -- and I mischaracterized it a little bit -- that some faults are transmissive. How do you justify those two different opinions?

A Well, I believe the -- the document he was referring to in the -- in his testimony was an Exxon document talking about the entire Conroe oil field set of faults, and that some of them were laterally and/or vertically transmissive.

I did not review all the faults, particularly the ones that were outside of the cone of influence, but I do believe that within the Conroe field there would be places where the faults could -- as evidenced or as presented by Exxon -- could be laterally or vertically transmissive. However, I do not believe this specific fault is.

Q Okay. And, Mr. Grant, I want to understand all your reasons for believing this fault to be nontransmissive. Other than your general description of the stratum -- or strata, I suppose -- which would seem to be true no matter where a fault occurred in the Cockfield, that they are all consistently sand

shale layers, how would you distinguish this fault from other faults in the Cockfield?
A Some of the faults in the Cockfield do not -- based upon the Exxon mapping -- do not provide a hydrocarbon trap. This fault provides a hydrocarbon trap where the upper Cockfield sands provide -- are reservoirs higher up in the section. The middle and lower Cockfield are apparently barren of oil and gas, but the upper Cockfield provide -- has hydrocarbon trapping. And the mechanism for that would have to be a sealed fault, because it's not a four-way closure structurally.
However, it is -- the hydrocarbons appear to be nestled up -- to use a non -- to use a layman's term -- but to be nestled up against the fault plain and appear to have stopped as they migrated laterally and up -- the slight structure up towards the dome would appear to have been stopped by the fault plain and form a trap that was later produced by Exxon and other operators in the field.
Q And that was only in -- with respect to the upper Cockfield, correct?
A As far as I know, there's no lower and middle Cockfield production; however, I do not believe that means that the middle and lower Cockfield sections



along that fault are transmissive. I do believe that the lower and middle Cockfield sands did not have -- at this location and the fault block did not have hydrocarbons that ever migrated through them to come up against that fault and form a hydrocarbon.
Q So, for instance, on the diagram, if we looked at the shale layer between the middle Cockfield and the upper Cockfield and the offset barrier there that you claim would be nontransmissive, no hydrocarbons have ever been found in that barrier in the middle Cockfield. Is that correct?
A Not that I have found on any of the maps that I have reviewed.
Q Same question regarding the lower Cockfield and the middle Cockfield, no hydrocarbons have been produced from that nontransmissive area, if you're correct?
A Not that I have found.
Q So the solely productive zone would be -- would still be the upper Cockfield, correct?
A As far as what I have found in the Exxon hearing files, correct.
Q And I assume you were diligent in your review, were you not?
A Yes, I believe I was.



Q All right. So with all your diligence and all your review, you did not find hydrocarbon production in the nontransmissive area between the lower Cockfield and the middle Cockfield, or between the middle Cockfield and the upper Cockfield, correct?
A Not along this specific fault, no.
Q Now, what is an attic? Do you know the term "attic" when referring to a fault in production of hydrocarbons?
A Yes, I do know what an attic is.
Q What is it?
A It's an area similar to an attic where you would have faults -- or where you would have hydrocarbons trapped.
Q Would you agree with me that a prime opportunity for a hydrocarbon trap in the diagram that we're looking at here, given that the upslope to these formations is toward the -- to the right of the paper -- that a hydrocarbons attic would most likely form between the Jackson and the upper Cockfield at the fault. Would you agree?
A Yes, I do agree with that.
Q So the fact that there's oil production on the northwestern side of the fault could be due to an attic formed by the Jackson shale, correct?



A It could be. However, it appears that the gas and oil column is greater than the amount of the -- of what you would call attic at that position.
Q Let's talk about in its virgin state. Do you know what I mean when say -- when I talk to or speak to virgin information?
A Yes, regarding a virgin oil reservoir and gas reservoir before it's been produced?
Q Yes, sir.
A Yes.
Q Tell me what the well information was on either side of the fault in its virgin state, if you know.
A What do you mean by the well information?
Q Well, I believe there's a point in time -- and it seems rather arbitrary in my mind -- where one determines -- or geologists in particular, maybe petroleum geologists in particular -- determine how the reservoir -- what was in the reservoir at this virgin time or at this point in time called the virgin production. Do you understand what I'm saying?
A Yes, I do.
Q And that means that when the field is first discovered and wells are produced on either side of a fault, there are observations made regarding the

levels or the depths to which oil and gas appear, correct?
A Yes.
Q Okay. And do you know what the information available in the Exxon records and other places indicates regarding the -- this fault as it pertains to the levels of oil and gas production -- or where oil and gas was found on either side of the fault?
A No, I just have the structure map showing the upper Cockfield, various horizons in the upper Cockfield showing the -- a plainer view of the trap.
Q So my point is that if -- if it were shown that the pressures or the -- I'm sorry, I think it is the -- it is done by depth to the zone -- depth to gas, depth to oil, depth to water. Is that indicative of transmissivity across the fault or connectivity across the fault?
A I'm not exactly sure what you mean.
Q Okay. I thought you had said a moment ago that the fact that -- and I don't think I'll be able to recall your words -- that you saw differences in the -- well, let me ask you to repeat it because that would be probably a lot easier and quicker.
What is it about the oil and gas production that lead you to conclude that the fault



was not transmissive?
A Because it was trapped up against the fault where laterally it did not migrate across the fault.
Q And I think we talked about that could be due to an attic, correct?
A Yes, we did.
Q In this particular case it would seem, given that the upslope side is to the right-hand side of the paper, it would be a prime opportunity for creation of an attic in the upper Cockfield?
A That is correct.
Q So it could not -- it doesn't necessarily mean that the entire fault is nontransmissive. It means that an attic in the upper Cockfield could exist and the hydrocarbon production could occur in that area?
A Yes, that is possible.
Q Now, I was going back to before the reservoir was produced, I guess, in significant quantities over the course of the Conroe field. You would agree with me that the oil and gas reservoirs have been tapped over the course of the last 70 years or so, correct?
A Yes, I would agree with that.
Q And in its virgin state -- again back to that portion of our discussion -- there's a point in time



where I think petroleum geologists would say, "These are the characteristics of the reservoir before it is altered by production." Am I somewhere in the neighborhood of what virgin state means?
A Yeah, that would appear to be correct.
Q All right. And would, for instance, that the oil level or where you would find oil, the depth to oil, if it were the same on either side of the fault, would that indicate anything in your mind regarding the transmissivity of the fault below the attic?
A I think it would be inconclusive as to what it demonstrated.
Q Would you not agree that it is more likely than not that if, before anything is produced out of reservoir, that if I find oil at the same depth on one side of a fault as I do on the other side of a fault, that it is likely due to connectivity -- or connectivity between those two underground reservoirs?
A No, I wouldn't agree with that.
Q As a reservoir is produced, presumably the water level rises and the oil level rises with it -- or the oil level rises and the water comes up behind it, correct?
A As what is produced?
Q I'm sorry, as oil or gas is produced off the



top of the formation.
A If the oil is produced, the gas cap could expand and potentially push the oil/water content downward. Vice versa, if the gas cap is produced, the water drive would potentially move the oil/water contact upward, depending upon which reservoir is produced. And, of course, if there's a lot of fault block, each might act independently of each other depending upon the rate at which they were produced and which hydrocarbon was produced.
Q Would that -- would a fault block -- well, given what you just said, the last portion of your answer, if indeed there wasn't transmission out of a fault block, wouldn't you expect them to behave differently? In other words, if they're not connected, they should not behave the same, correct?
A What should not behave the same?
Q Well, you're producing out of a well on one side of a fault. You're producing out of a well on the other side of a fault. So far okay?
A Okay.
Q And if the reservoir is behaving in a similar fashion on each side of the fault, would you expect it to be transmissive or nontransmissive?
A It could be either due to transmissivity or

similar production rates on both sides of the fault by those two wells.
Q All right. What I'm imagining is in this fault zone, across the fault, a pool of oil. Are you with me so far?
A Yes.
Q And I'm not up to the part where the oil has risen to a level where it is exclusively in the attic on, let's say, the northwest side and exclusively in the formation on, say, the southeast side. So far okay?
A Yes.
Q So while that reservoir is being depleted or withdrawn, you would expect it to behave similarly across the fault if it's transmissive. Is that correct?
A Depending upon the -- if it is transmissive, depending upon the level of transmissivity it might continue to balance or it might not.
Q Okay. So if it's a high permeable layer, say 1 darcy, can you draw any conclusion knowing the permeability of the upper Cockfield as somewhere in the order of 1 darcy or above?
A I don't know that that's a fact. I have no indications what the permeability of the upper



Cockfield is.
Q Well, assume with me for a second that it is one darcy. Would the phenomena I was trying to describe be more likely in a permeability of one darcy?
A If there was no -- no shale smearing or sand to shale contact across the fault, it would be more likely that the levels would stay the same on both sides of the fault, assuming all your other -- with all your other assumptions.
Q All right. Did you look at that information? Did you look at the virgin state of the reservoir as available in the Railroad Commission records?
A I did not see anything related to virgin pressures in the reservoir.
Q Would that help you in making a -- or forming an opinion as to whether the fault we've been discussing is transmissive or not transmissive?
A Not related to the lower Cockfield. It would make an opinion related -- it would affect -- not affect -- it would give an indication of lateral transmissivity potential across the upper Cockfield assuming all the production data on both sides of that fault could be provided. Short of that, it wouldn't necessarily give an indication as to the sealing



potential of this specific fault at the lower Cockfield level.
Q All right. The ceiling nature of the fault that you've focused on -- or that we've been discussing. I shouldn't say you focused on. Do you have any evidence that you can present here in this case that indicates it is nontransmissive other than the general characteristics of the sands we've been discussing?
A The general characteristics of the sand, the 50 to 60 percent shale and 50 -- 40 percent sand within the lower and middle Cockfield are the -- and the amount of throw on the fault of 150 feet are, in my geologic -- in my geologic experience -- is indicative that that fault is very likely laterally --
JUDGE EGAN: Is laterally?
WITNESS GRANT: Yes, laterally and virtually sealed.
JUDGE WALSTON: Sealed?
WITNESS GRANT: Sealed, sealing, or a no-flow boundary, a pressure boundary.
Q (By Mr. Riley) And again, to a layperson maybe this is -- just doesn't seem logical to me, maybe it's not to everybody else, but the -- why wouldn't this same analysis apply to any fault that is



identified in the upper, middle or lower Cockfield?
A Well, because the lower and the middle Cockfield have more shale percentages than the upper Cockfield -- not by a really huge amount, but they tend to be dirtier or less clean sand in the middle and lower as evidenced by previous testimony of higher permeability in the upper and medium and lower permeability in the middle and lower Cockfield.
Q Well, let me ask you a question then being specific to the middle and lower. Why wouldn't the same analysis apply to any fault found in the middle or lower Cockfield, that it is -- since it's such a high shale content -- that any faulting in those layers would form nontransmissive faults both laterally and vertically?
A And I can only speak for the one fault that I have reviewed in detail, which is this fault, not all the faults in the Conroe oil field. But to this specific fault it would seem to me to be a strong indicator that it is laterally sealed.
Q What about vertically sealing?
A Yes, I believe it's vertically ceiling.
Q Okay. Now, other than the throw -- or the offset as we've been calling it -- what other information do you have about that fault that makes it

unique in terms of how you analyzed the available information?
A There's nothing else that makes it unique.
Q Okay. So the shale content and the throw or offset are all that you're drawing on to say that it's vertically and laterally sealing?
A Also my general knowledge that if you've got at least 30 to 40 percent shale in the tertiary section of the Gulf Coast you generally have a sealing mechanism -- or you often have a sealing mechanism laterally on a fault.
Q Let me ask you a question about the number of oil wells that are depicted on a number of different diagrams, but there's a good number of oil wells that were to the south and east -- excuse me -- yeah, south and east of the fault -- the fault that we've been discussing -- and fewer to the north and west.
A Correct.
Q Does that indicate that there's less oil and gas production from the north and west on the -- as it pertains or as it relates to the fault?
A No, it appears to me to indicate that as you reach the crest of the structure on the deep-seated salt feature at the Conroe field that the faulting becomes much more closely spaced or prevalent than out



on the flanks of the field.
Q All right. The difference and the distinction in all this discussion really is that you modeled the 14 -- or 4400-foot fault as a pressure barrier -- correct? -- using the PRESS2 model?
A That is correct.
Q Did you do any modeling using 500 millidarcies in the PRESS2 model?
A Did I do any modeling -- no.
Q If you did modeling using 500 millidarcies as your permeability, even if you assumed the fault to the southeast, the one we've been discussing, to be a pressure barrier, what is your cone of influence?
A I don't know what the cone of influence would be with 500 millidarcies.
Q So your cone of influence that you calculated at some 14,000 feet assuming the fault to be nontransmissive is not relevant to an analysis assuming the permeability to be 500 millidarcies, correct?
A Not if it's 500.
Q So that --
A But I do not believe -- I did not run it with 500 millidarcies because (inaudible)
Q I know you believe that, but we discussed --



JUDGE EGAN: Hold on. I couldn't hear his last answer.
MR. RILEY: I'm sorry, Judge.
JUDGE EGAN: I'm losing -- the very end is -- you fade out. What was the last part of what you said?
THE REPORTER: I was trying to stop you, too.
WITNESS GRANT: I did not use 500 millidarcies in my pressure model. I used 81 millidarcies because I believed that 81 millidarcies was more a appropriate value for permeability.
Q (By Mr. Riley) But it's only an appropriate value, Mr. Grant, if in fact the TCEQ would not require the applicant to demonstrate that 500 millidarcies is conservative in its modeling and submitted with this application?
A It appears that the TCEQ has not -- has accepted 500 millidarcies as appropriate in that they have -- in the pressure modeling in that they have issued a draft permit with 500 millidarcies in the pressure model and discounted the actual measured average permeability for the perforated interval as presented in the completion report for WDW-315.
Q But we're not going to inject into WDW-315 as



currently perforated. You understand that?
A I have no --
Q You just read special conditions --
A -- does not appear to be any -- am I speaking loudly?
JUDGE EGAN: Yeah, you can go ahead.
A -- does not appear to be any guarantees or requirements in the draft permit as currently written that specifically requires TexCom to do those things as the applicant states they will.
Q Take a look at Page 6 of 24 -- we covered it earlier -- and the special condition letter G. I'll read it to you while you're looking, just make sure I read it correctly: "This permit is based on, and the permittee shall follow, the plans and specifications contained in the Class I underground injection control application dated July 29th, 2005 as revised," and then it gives a number of dates, "which is hereby approved subject to the terms of this permit and any other orders of the TCEQ."
What about that is ambiguous in your mind as to whether the applicant must recomplete the well across 145 feet in the lower Cockfield zone?
A It's ambiguous because it does not specifically state that in there, and I believe that

that is not clear enough direction to the applicant as to what they would have to do once the permit is issued.

JUDGE EGAN: I believe, Mr. Riley, you've covered this territory.

MR. RILEY: Thank you, Your Honor .

Q (By Mr. Riley) If the applicant demonstrates that the permeability is 500 millidarcies based on the -- your assumption that the fault to the south -- southeast is nontransmissive, what is the cone of influence?

A I do not know what the cone of influence would be based upon 500 millidarcies and a nontransmissive fault to the south.

Q Would it be --

A I do --

Q Please continue.

A And the BOAST model as currently presented not only provides a thickness of 145 feet, but laterally to the south increases it to 401 feet, which is obviously not the scenario of a no-flow boundary.

Q Well, I hear you, and that's not my question. You made it very clear that you think that the fault should have been modeled as a pressure boundary. And you also made it very clear that you used 81



millidarcies and you're not confident the applicant would have to demonstrate any different permeability to the TCEQ before injecting waste into WW-315.

But what about the other wells, sir? Are you convinced that the TCEQ requirements, regardless of your opinion about WDW-315 or future WDW-410 -- are you convinced at least the other wells, the other three proposed wells, would be required to demonstrate that 500 millidarcies was conservative?

A I don't know if -- what the other wells, once they were completed, would come up with as far as a permeability once they are completed, but it would be my opinion that the permeability is demonstrated during the Fall-off testing as part of the completion of those wells would be inputs -- or required to be submitted to the TCEQ for review for conservativeness of those -- of the pressure model for those wells.

Q Let's talk WDW-411.

A All right.

Q Which would have a permeability of 500 millidarcies demonstrated by a Fall-off test under your very last answer, correct, in order to pass TCEQ post-drilling review, correct?

A Correct.

Q What is the cone of influence assuming a



nontransmissive fault for WDW 411?

A I do not know what it would be because I cannot tell you at this point what the thickness perforated would be. Therefore, it would directly affect the cone of influence, and I do not know that 500 would be -- millidarcies would be the result of a Fall-off test for those other wells.

Q Sir, in each of your applications, the ones you've sponsored -- and I think the word is marshaled through the process in your prefiled testimony -- you don't have Fall-off test data for those wells, do you?

A No, I do not, not typically.

Q Okay. So that would be more typical of WDW-411, correct? That would be exactly the same situation?

A That is correct.

Q So in your instance and the instances you've actually represented a permit applicant and assisted them with their permit application, what have you used? How have you determined permeability in those instances?

A Before or after the well is drilled?

Q Well, before. I'm talking about a fresh, new greenfield as we might refer to it where you're going to put a Class I nonhazardous injection well. Are we



together so far?

A Yes.

Q Is that analogous to any of the other three wells WDW-411, WDW-412, and WDW -- I hope it's 413.

A It is analogous to those other ones, yes.

Q All right. So in no way does the TexCom application -- is it different from applications you've handled where you have not had Fall-off test data for new wells, correct, or new proposed wells?

A It is different in that there is wells -- one well exceedingly close that does have Fall-off test data for the same reservoir that 411, 412 and 413 have proposed for injection into.

Q Sir, are you required to do a Fall-off test for each well you propose?

A Yes, I am.

Q Okay. So again, the Fall-off test and the available data for WDW-410 is not relevant for my questions regarding 411, 412 and 413. Would you agree?

A No. It is relevant as far as the preliminary modeling that you would do before you drilled the well. You would use the most closest site-specific permeability that you could to generate your pressure model.

Q So you're saying that the applicant, because it has a well with 81 millidarcies from a Fall-off test completed in a different interval than what it's proposing is bound to 81 millidarcies for all purposes in modeling the new wells?
A Before the wells are drilled my belief is that it should be using 81 millidarcies until that can be either proven up or proven to be not correct.
Q Well, it's going to be relatively difficult to do that unless the new zone is perforated under this permit and it is evaluated for permeability in a Fall-off test and reviewed by the TCEQ. Wouldn't you agree?
A I would agree.
Q So presumably then you would agree that the permit should be issued; that the Fall-off tests should be done, both in the existing well and any future wells that are drilled; and that those assumptions should be evaluated against -- excuse me, those results should be evaluated against the assumptions made in the modeling to determine whether the modeling was conservative?
A For the three undrilled wells, I agree with that. For the currently-drilled well I do not believe the safeguards are in place.



Q The safeguards in place would just be a condition that said, "Treat this as a new well, do a new Fall-off test after you've reperforated in the interval that you propose and send us the data and we'll tell you whether you can accept waste or not," correct?
A Assuming that that Fall-off test also went out a radius of investigation to determine whether the fault to the south was laterally a pressure boundary or not.
Q So you would want a --
JUDGE EGAN: Mr. Riley, some of these questions are getting very repetitive. I know the answers at this point and I believe Judge Walston knows the answers.
MR. RILEY: I'm trying just to get the answers from the witness, Judge.
JUDGE EGAN: Well, the witness has already given you the answer. He's not going to agree with you no matter how many different ways you ask it.
Why don't we take a short 10-minute break and come back at quarter til 5:00, and --
MR. RILEY: I think I will probably be done at that point, Judge, but I will have to review my notes just briefly.



JUDGE EGAN: All right. Why don't you take a moment and review your notes, but it's not necessary to go back over material we already have the answers to.
MR. RILEY: Thank you.
(Recess: 4:32 p.m. to 4:45 p.m.)
JUDGE EGAN: Is everybody ready to get back on the record? We were still in cross. You may proceed, Mr. Riley.
MR. RILEY: Thank you, Your Honor.
Q (By Mr. Riley) At the risk of aggravating certain folks in the room, let me just ask you some questions from your sworn deposition. By the way, I took your deposition in this case on November 28th, 2007, correct?
A I believe that's the case, although I'd have to check my own records as far as the date.
Q Have you reviewed the transcript and have you signed the deposition?
A I have.
Q And were the answers in that deposition that you gave to my questions truthful?
A To the best of my knowledge and intent they were.
Q I'm referring to Page 65, Line 10 of that



deposition. I'm going to read to you and tell me if you remember being asked these questions and giving these answers, Page 65, Line 10: "Question: So in fact if you were right that 81 millidarcies is the right value after the well is completed in the interval proposed, after all that drilling and testing is done, what would happen?
"Answer: They would have to redo their pressure model --"
I interrupted inadvertently with "Okay."
You continued "-- to either demonstrate that there is not an endangerment issue with that lower pressure or would potentially have to go into abandoned artificial penetrations that penetrated the injection interval and replug them.
"Question: So the system takes care of that, takes care of the miscalculation in the modeling submitted as part of the permit application."
Your answer: "Yes, it should.
"Question: All right. Is there any reason you have to doubt that that would be the process followed in this case?
"Answer: No."
Were those answers truthful to the questions I asked you at your deposition?

A Yes, they were.
Q One more set of questions on a different topic in your deposition, then I believe I'll be through. This was in -- regarding the public interest aspect of your work in developing UIC permit applications. Do you recall a series of questions regarding public interest?
A I'm sure I will when you read them.
Q Again, it's on Page 85, Line 1 of the deposition.
"Question: And is it your opinion that it is a safe method of waste disposal?
"Answer: Yes."
Do you recall that being -- referring underground injection control as a method of waste disposal.
A I believe so.
Q "Question: In the applications that you've prepared, have you demonstrated in each occasion that the application is in the public interest?
"Answer: I believe I have.
"Question: And how have you done that?
"Answer: Through the technical report and demonstrations within the technical report demonstrating the safety of injection in that specific



location.
"Question: Now, I think -- at least as best I read your testimony and heard your testimony today -- as best I am humanly capable of doing that -- you have no objection to the -- from a subsurface geological perspective -- to an injection well completed in the sand that's proposed in this application. Is that correct?"
"Answer: That is correct."
Do you remember being asked those questions and did you give those answers --
A I believe that is correct.
MR. RILEY: Thank you, Mr. Grant. I have no further questions.
JUDGE EGAN: Mr. Williams?
CROSS-EXAMINATION
BY MR. WILLIAMS:
Q Good afternoon, Mr. Grant.
A Good afternoon.
Q You say in your prefiled testimony that you believe the area is geologically suitable for underground injection of industrial solid waste. Is that correct?
A That is correct.
Q But you also further say you don't believe



this specific location is appropriate. Can you distinguish between those two?
A Suitable meaning the reservoirs there which would accept fluid, appropriate in that I'm concerned about the pressure increase due to injection and the potential for artificial penetrations to serve as conduits of fluid out of the injection zone into the -- into a USDW unless certain concerns I have related to the application are addressed to my satisfaction.
Q To your knowledge of the TCEQ UIC rules, is there a provision for appropriateness of an injection zone?
A I'm not exactly sure what you mean by appropriateness.
Q Is "appropriate" as you have used the word in your prefiled testimony defined or used in TCEQ rules?
A Yes, I believe they do have in their review of a permit application -- have that requirement to determine appropriateness.
Q And under -- in what context is it used? Appropriate as to the --
A To location on the surface, to subsurface strata in which to inject, to defining operating parameters and permit pressure and flow maximums and



other technical issues.
Q Okay. Have all of the UIC applications that you've worked on in the past been for new wells?
A No, sir. Some of them have been for permit renewals or permit amendments of existing wells.
Q Have you ever converted a previous well to a Class I?
A No, I have not -- you mean like an oil and gas well to a Class I or --
Q Any kind of conversion.
A Not that I can remember.
Q Well No. 315 exists, right?
A That is correct.
Q Is it currently permitted?
A I do not believe the current 315 permit is active at this point.
Q So --
A -- I'm sorry.
Q That's okay. Go ahead and finish.
A And the 410 permit application has -- is in draft permit stage.
Q So we have a well that is in existence but not permitted. And it -- and the applicant is applying for a new permit for that well, correct?
A That is correct.

Q Then why would there be anything less than a completion report required?
A Because the applicant has already provided the completion report for the well as previously presented under the 315 drilling and completion. So I do not anticipate an additional completion report to be filed for 410.
Q If it were clear that the TCEQ would require a full, complete new completion report for 410, would that allay your fears?
A That would -- and all the -- all the accompanying requirements as -- of a new well, including incorporating the results of either the current Fall-off test or revised Fall-off test, if it was done, were included in that completion report and demonstrated that the modeling as currently presented is conservative -- or remodeling presented to show a new cone of influence and addressment of wells within that revised cone of influence of essentially -- and a determination of the fault being either laterally a pressure boundary or not. That would significantly allay my concerns about this application.
Q So you would agree that a recalculation of the area review and the cone of influence is normally done on a new well as part of the completion report.



Is that correct?
A Yes, that is -- that is typically the case.
Q Good. In your experience with underground injection control permits that you have worked on, aren't TCEQ rules in Chapter 331 incorporated into the permit?
A I believe they are.
Q And so if the rules were to be interpreted as requiring a full completion report on this kind of strange animal -- the conversion of an existing well previously permitted to a new permit -- then it would include all those other things -- the calculation, the area of review and the cone of influence, correct -- and a new Fall-off test?
A If that were incorporated in specifically -- and not just by rule -- but the specific checklist of issues that I have brought up, I would be -- I would feel that was --
Q More comfortable?
A Right. I would be more comfortable with that, yes.
Q Have you ever -- on any of the permits that you were involved in in the past, have you ever modeled a Class I well with this low permeability?
A Yes, I have.



Q And was it permitted?
A Yes, it was.
Q Have you ever -- have you ever completed a Class I well and the permeability Fall-off -- the Fall-off test indicated a permeability higher than what you had modeled?
A Yes, I have.
Q And did the applicant or TCEQ immediately increase the amount of fluids that can be injected?
A No. They assumed that the -- in my case anyway -- that the modeling was conservative and left the operating parameters the same.
Q On the other hand, if you -- if you complete the Fall-off test and determine a permeability less than what you modeled, TCEQ demands that it be, you know, scaled back. Is that correct?
A They required that I present a new pressure model, and they determined certain operating parameters as to be lower or more conservative as a result of that.
Q But the overall effect of that is that there's less waste that can be disposed of -- is that correct -- through that well because of the lower permeability?
A It can be less waste, or it could be a lower



maximum surface injection -- flowing injection pressure.
Q But if there's less pressure, then there's less going down. That correct? Is that safe to say?
A If you don't reach your maximum wellhead pressures with a similar rate, then you could potentially inject the same amount. You would just have a -- less of a range of wellhead pressures to work with.
Q Okay.
A Maximum -- less of a maximum wellhead pressure to bump up against.
Q But in your experience, based on the Fall-off tests, if it's higher than what you modeled, the TCEQ will not let you automatically have extra pressure to put down the well. But if it's lower than what you modeled, they will require cutting back on the various aspects that you mentioned. Is that correct?
A They won't --
Q -- to be more conservative?
A They won't require or they will require?
Q Let me rephrase. If you do the Fall-off test and the permeability is greater -- higher than what you had modeled --
A Yes.

Q -- you're not automatically given the opportunity to increase the amount of waste that you're disposing or increase pressure or put more underground. You have to stick with what you applied for. Is that correct?
A Typically that is the case.
Q But if it's less, if the Fall-off test pressure is less, then you're required to be more conservative. Is that correct?
A Typically you are required -- or they -- the TCEQ will require you to change some of your operating parameters to stay within that new calculated pressure.
Q And based on your Fall-off tests, if it's less than what you had originally calculated or modeled, aren't you also required to change and adjust your area of review and cone of influence?
A You would have to change -- recalculate your cone of influence. If it did not exceed two-and-a-half miles, you would not have to change your area of review.
Q Gotcha.
JUDGE WALSTON: Mr. Williams, I think you said if the pressure is less, I assume meant if the permeability is less --



MR. WILLIAMS: If the permeability -- yes. I'm sorry. Thank you.
Q (By Mr. Williams) Have you ever had a well for any of your clients that -- for which you had to address corrective action?
A Could you define "corrective action" for me?
Q Such as your annual report indicating a larger area -- a larger cone of influence and you would have to go in and plug abandoned boreholes?
A No. In the annual report typically one does not recalculate the cone of influence but provides only the results of the Fall-off testing. If it's included with the annual report versus included with the mechanical integrity test and report, either way you would present the results of your Fall-off testing in a permeability value.
But you would not necessarily, unless the TCEQ reviewer required it, go in and recalculate a cone of influence. That is, at least in my experience, primarily limited to the permitting or permit renewal process -- or the permit amendment process.
MR. WILLIAMS: I have no other questions, Your Honor. Pass the witness .
JUDGE EGAN: Okay. Do you have any



questions?
JUDGE WALSTON: I do.
JUDGE EGAN: Okay.
CLARIFYING EXAMINATION
BY JUDGE WALSTON:
Q I just have a couple of questions to make sure I'm clear on one item. As I understand, the cone of influence is the area where the pressure of the injected waste is high enough that it's going to overcome -- I think we talked about a mud plug, correct, in an abandoned well, for example?
A In this application, a 421-psi pressure increase within the injection reservoir -- 421 or larger -- was calculated to displace a 9-pound-per-gallon mud plug in an old abandoned borehole that had 9-pound-per-gallon mud filling it, minus 50 feet of drawback from the surface.
Q Well, and my question to you is: Do you agree that it is a reasonable assumption that one of these abandoned wells is going to have a nine-pound mud plug in it?
A Most of the wells that were plugged in -- I believe in the early years of the production of this oil field were probably plugged -- or likely plugged only with mud. And the more recent ones are typically



plugged with mud as well as cement plugs at various depths within the wellbore.
Q Right. So that's a conservative assumption?
A Yes, nine-pound-per-gallon mud in it filling a borehole without any other plugs of any sort is a conservative assumption.
Q And I guess my point is for the Judges, realistically we don't need to worry about some open borehole without any mud or any kind of plug in it?
A Well, as the TCEQ assumes the most conservative case is a -- sans any additional records to the contrary -- assumes that a borehole of which there is limited or no plugging information is assumed to have that conservative situation of a nine-pound-per-gallon --
Q That's part of the rules?
A That is part of the guidance document for the permit application as presented by the TCEQ. That does not mean that there is a borehole out there that might be just filled with brine or walked away from and a fence post thrown into it. But the default, worst-case scenario is -- as allowed by the TCEQ guidance document is nine-pound-per-gallon mud in the borehole.
JUDGE WALSTON: Thank you.

JUDGE EGAN: Anything else?
JUDGE WALSTON: No.
JUDGE EGAN: Mr. Hill, any redirect?
MR. HILL: I do have some redirect, Your Honor.

REDIRECT EXAMINATION

BY MR. HILL:

Q Mr. Grant, could you explain what a well conversion is?

A A well conversion from -- there's many kinds of well conversions -- conversion from a oil well to a gas well to -- from a gas well to an oil well, from either one of either of those to a salt water disposal well. There's even the possibility of conversion of an oil and gas well or a dry hole which has casing in it to a Class I injection well, although that is fairly uncommon.

Q Do you know if what TexCom proposes to do with WDW-315 would be considered to be a conversion under your understanding of what that term means?

A No, I think it would be essentially a Class I well drilled and abandoned that another operator wishes to take as a -- to permit as a new Class I injection well.

Q The point of my question was whether or not



you believe that whatever rules might exist in TCEQ rules that deal with well conversions, whether or not based on your professional experience you would expect those rules to apply to this well in this set of circumstances?

A Any well, whether it was drilled as a Class I or some other format, would have to meet Class I construction and permitting standards prior to issuance of the permit and/or beginning of operations.

Q So you don't believe that the conversion rules would apply to this well in this case?

A I'm not sure what you're talking about when you say conversion rules.

Q Well, to be honest with you, in all candor, I'm not sure what I'm talking about either, but I know Mr. Williams had mentioned the issue of conversion and I was curious to know if you thought that this well might potentially qualify as a well conversion under TCEQ rules?

A I believe what -- and I can't speak for Mr. Williams, but I believe when he's talking about conversion, he's talking about a conversion of some other well type to a Class I injection well, and that would be a generic term of conversion. However, that conversion of the well would require that that well



meet Class I permitting standards.

Q Are you familiar with the term "workover"?

A Yes, I am.

Q Can you explain what that means?

A A workover of a well can be due to several reasons. You can lose mechanical integrity of the well due to either a casing or tubing leak. Or you could -- and that would be -- then you would have to take the well apart, meaning take the tubing and/or packer potentially out and either put in new tubing or pack or maybe put in a casing patch, and then put the well back together.

Or an additional type of workover might be to clean out sand in the bottom of the borehole to open and cover up perforations. There's many kinds of workovers, many kinds of remediations of wells for various and sundry reasons that occur.

Q What about adding perforations to an existing well?

A Typically adding perforations to an existing well would be considered a workover and a workover report would have to be filed.

Q Okay. And can you explain what a workover report consists of, based on your experience?

A Based on my experience, a daily chronology of



the actions performed on that well would be provided in a report, as well as a summary of the additional perforations and those depths of those additional perforations and what potential stimulation of those perforations might occur, and also a discussion of the -- if the tubing or -- if the tubing is removed to do that, the results of mechanical integrity testing after the well is put back together again would be included in that workover report.

Q What about an injection Fall-off test?

JUDGE EGAN: I'm sorry, I couldn't hear you.

MR. HILL: I apologize, Your Honor.

Q (By Mr. Hill) What about an injection Fall-off test? Is that typically part of a workover report?

A To the best of my knowledge it is not typically required for a reperforating of an injection well. Operators might do it, but it's not a requirement that a Fall-off test be performed.

Q Do you have access to Volume 10 of the TexCom exhibits submitted as part of the prefiled testimony? Specifically I'm referring to Exhibit 21, which, if I understand, this particular exhibit correctly, it is part of a response by TexCom for one of the -- one of

the NODs submitted by TCEQ. But my question, though, is specifically related to Exhibit 21, Page 21 of 47, if I could draw your attention to that page.

A I have it.

Q If you would draw your attention to the first paragraph on the page, under that -- under the Table 6-7. And specifically I'm looking at the second-to-the-last-sentence of the paragraph. Let me read that to you and make sure that -- let me know if I don't read it correctly. "Once TGD," which I believe is an abbreviation for TexCom Gulf Disposal, "receives their permit for operation, the well will be reperforated in more favorable portions of the injection zone as described in Section 6-A.12."

Is there any indication in that statement whether or not -- particularly when TexCom proposes to conduct the additional perforations that they propose as part of their application for WDW-410?

A No, it is stated that the well will be reperforated, but it is not stated as to when.

Q So do you understand in reading this sentence -- certainly I don't intend to put any words in your mouth -- that TexCom proposes to add perforations after they receive their permit, but is there any particular indication there in whether or



not they commit to complete those perforations before the well is actually put into production or before the well becomes operational?

A There is no indication of the time frame that that will occur.

Q So when the applicant asks whether or not the application is boot-strapped, so to speak, into the terms of the draft permit itself, and I by no means intend to suggest that this particular sentence reflects TexCom's entire position -- there may be a more detailed presentation of their plans in this application that I haven't found.

But based on your reading of this particular indication of their proposal, is there anything that leads you to believe that TexCom would be required, if the draft permits were issued as they are proposed today for WDW 410, that they would be required to conduct -- or rather that they would be required to add additional perforations into the sands that they considered to be more favorable and that they be required to do that before operation and to conduct Fall-off tests before operation?

A No, not that they would have to perforate immediately.

Q And based on your understanding of TCEQ rules



and your understanding of how the UIC program operates, is there any -- do you have any understanding at all whether or not even if a Fall-off test was conducted, say, voluntarily by TexCom, that TCEQ would be required to review that Fall-off test as though it were part of a completion report -- meaning that the cone of influence that was calculated by TexCom as part of their application would be subject to scrutiny and potential amendment by TCEQ based on the results of that Fall-off test?

A As best I can tell, there's no requirement in the permit at this point to that effect.

Q Let me ask you, if you wouldn't mind, to take a couple of minutes with me to help maybe explain a little bit about what's going on with TexCom's proposal with respect to the lower Cockfield specifically, I'd like to have your help in describing the difference between the current perforated interval of WDW-315 and the proposed injection interval that TexCom describes in their application. Can you define, in terms of depths the current proposed injection interval that TexCom proposes to inject into as part of their application?

A I can. I'll have to look in -- to get the exact depths I'll have to look in some of their



documents to do that.

Q Okay. Do you have the documents in front of you? Or if I were to give you the depths would you be able to discern whether or not those are accurate?

A If --

Q Let me ask you --

A I can find the document.

Q Is it your understanding that the top of the proposed injection interval of TexCom is -- begins at the depth of 6,045 feet?

A I believe that is correct.

Q And is it your understanding that the bottom of the proposed injection interval of TexCom terminates at a depth of 6,390 feet?

A That is correct.

Q And just to make sure we can correlate all our data, is that also your understanding of the depth of the lower Cockfield formation at WDW-315?

A Yes.

Q Okay. So within that depth of 6,045 feet down to 6,390 feet, do you recall whether or not WDW-315 is perforated or -- we know it's perforated within that zone. Do you recall the zone that it is perforated in within those depths?

A I would have to look that up. It's in this

document here.
Q Do you have that data available to you?
A Not immediately. I'll have to look for it.
Q Let's see if I can speed this along and ask if I were to tell you that the current perforated interval begins at a depth of 6,184 feet, does that sound accurate to you?
A I believe that is the correct number.
MR. RILEY: You know, Judge, I don't mind a little leading, and I certainly don't object to speeding things along. But essentially Mr. Hill is testifying for the witness, not asking questions and getting answers.
JUDGE EGAN: If you believe the figures are incorrect, make your objection. But at this point, I think it's beneficial to speed things along.
MR. RILEY: I understand.
MR. HILL: Obviously, Your Honor and Mr. Riley, I fully expect that Mr. Grant's testimony will be subject to cross-examination as appropriate.
MR. RILEY: Well, it would just be helpful for it to be his testimony unless you want to take the stand, but --
JUDGE EGAN: I think that he made it real clear that he'd have to look it up and Mr. Hill



is trying to refresh his memory as to whether or not those numbers are correct. If you believe they're incorrect, let me know. But otherwise, we're getting close to the end of the day and if we can finish with this witness it would be beneficial.
MR. RILEY: I'm fully on board with that.
Q (By Mr. Hill) If I were to tell you that the perforation of the current -- or the current perforated interval terminates at a depth of 6,372 feel, does that sound correct to you?
A Yes, it does.
Q And do you remember in your review of the TexCom application, within that 188 feet of current perforated interval, the total extent of sands that are perforated into WDW-315?
A I believe the application states that 100 feet of sand -- of the sand reservoir are perforated -- of net sand reservoir.
JUDGE EGAN: I'm sorry, what was it?
WITNESS GRANT: Of the net sand reservoir.
Q (By Mr. Hill) So that means out of the 188 feet of perforated interval, there's only available 100 feet of sands to be perforated into, or



that the previous operator-owner of the well decided to perforate into. Is that correct?
A That is correct, of the overall perforated interval. And I believe as stated in the application, 100 feet of net sand were perforated.
Q Okay. And can you explain your understanding of what TexCom proposes to do with WDW -- what would be WDW-410 with respect to the perforated interval?
A In the application TexCom indicates that they intend to perforate an additional 45 feet of sand -- net sand within the lower Cockfield injection interval, and to reperforate some of their currently perforated interval to bring the total net perforated interval up to a maximum for the net available sand with that -- within that interval and bring it up to 145 feet.
Q So if I understand your testimony correctly, the proposal would be to -- well, let me ask you -- would the proposal be to abandon the current 100 feet of perforated interval and find 145 feet of sand somewhere else? Or would the proposal be to incorporate that current 100 feet of sands, along with 45 feet of additional sands in the lower Cockfield?
A It would be to add an additional 45 feet of sand perforated and to reperforate some of the -- or



possibly all of the 100 feet that is -- of net sand that is currently perforated.
Q And as we've discussed -- and sounds like fully fleshed out -- a follow-up test has already been conducted on that 100 feet of perforated sand. Is that correct?
A As presented in the original 315 completion report and as noted in the TexCom application. That is correct.
Q And what was -- and what did the results of that injection Fall-off test tell us with respect to the permeability of those 100 feet of sands that are currently perforated in WDW-315?
A It indicated that the net average permeability of that hundred feet of perforated sand is 81 millidarcies.
Q You speak to average. Can you explain a little bit about that -- your use of that qualifier?
A The Fall-off test analyzes the entire section or perforated interval of the reservoir that is open to receive flow during that test. And so, therefore, the results of the Fall-off test are an average for that entire hundred feet.
JUDGE EGAN: I may be confused. Wasn't the perforation greater than 100 feet? The hundred

feet was just of the sand?
WITNESS GRANT: No, an overall perforated interval is noted of about -- from a top to a bottom of 188 feet. However, best as I can tell from the records, that was -- 188 feet was selectively perforated at various depths across the sands present in that 188 feet. And so a --
JUDGE EGAN: Okay.
WITNESS GRANT: -- net perforated interval was 100 feet, not 188 feet.
JUDGE EGAN: I understand. Thank you.
JUDGE WALSTON: Mr. Hill, just so I'm clear and the record is clear, when you started this line of questioning -- maybe I'm hearing things -- I wrote down WDW-410, but this has all been related to the existing well, WDW-315.
MR. HILL: I apologize for the confusion, Your Honor. If I understand the application correctly, the existing well as it exists today at one time was permitted by TCEQ as WDW-315. That particular well, if these draft permits are issued, will be recognized by TCEQ as WDW-410.
JUDGE WALSTON: Okay.
MR. HILL: So there is an interchange there, and I apologize for the confusion.



JUDGE WALSTON: Okay.
Q (By Mr. Hill) The applicant has suggested that the permeability -- the applicant has suggested that they anticipate the average permeability of the entire lower Cockfield -- that is all of the 145 feet of available sands acceptable to receive injected waste is somewhere around -- well, is 500 millidarcies. Is that correct?
A Yes.
Q Can you explain why you believe, based on -- let me take a step back. You put a lot of importance on the data from the current 100 feet of perforated sands, do you not?
A Yes, I believe it is representative of the perforated reservoir at this time.
Q Okay. How -- can you explain then, based on that information, why you believe 500 millidarcies is an unrealistic expectation of what that -- the permeability of those 145 feet of sands would likely be?
A Well, to get -- to add an additional 45 feet of perforation of sand to get a maximum reservoir thickness in the injection interval of 145 feet, one would have to have a permeability of the remaining 45 feet exceed something like 1400 millidarcies to



provide an average for the entire interval of 500 millidarcies.
Q Now, we do have some data on the permeability of at least portions of the strata that's not yet perforated into but is part of the lower Cockfield, do we not?
A Yes, we have a 14-foot core that was taken during the drilling of 315 through one sand in the upper portion of the lower Cockfield, which is above -- about 100 feet above the currently-perforated interval.
Q And if you recall, was a test conducted to determine the potential or the permeability of those sands that were bored?
A Plugs out of that 14 feet of core probably on -- 2-inch plugs were drilled out of -- five 2-inch plugs were drilled out of that 14 feet and submitted to a petrophysical laboratory for analysis of permeability and porosity, and the results of those analyses are included in the completion report for 315.
Q Do you recall what the results of those tests suggested?
A They provided a range of permeabilities of over 800 millidarcies to approximately 6 millidarcies



with, I think, an average of those five cores of approximately 390 millidarcies as stated in the core analysis report.
Q Do you have Volume 9 of the TexCom prefiled testimony available to you?
A Yes, I do.
Q Would you turn your attention to TexCom Exhibit 11, specifically Page 146 of 270?
MR. RILEY: I'm sorry, what page counsel?
MR. HILL: 146 of 270.
A Yes, I have it.
Q Could you explain what -- what the data on this page --
JUDGE WALSTON: Give us second --
MR. HILL: Sorry.
JUDGE EGAN: Exhibit 11?
JUDGE WALSTON: Go ahead.
Q (By Mr. Hill) When you were referring to the ranges of the core samples taken, is this the information you were referring to?
A Yes, it was.
Q Could you specifically point us -- there's several columns of information here. Could you point is to the columns that you're referring to?

A There are two subcolumns under the permeability millidarcies column. And there are five sample depths to the left of that showing the depths at which the core plugs were taken and the results of permeability analyses.

The permeability is typically -- in this form of analysis -- run using air to flow through the core and then a correction factor for liquid, which is a Klinkenberg correction factor is applied to those results, which typically is more reflective of the conditions of the rock when fluid is -- as you would have in a natural subsurface environment. And those permeabilities for those five depths are noted on the Klinkenberg 2000 psi column.

Q Based on this particular set of data and based on your understanding of the sand and shale composition of the lower Cockfield and based on your understanding of the results of the Fall-off testing that was taken on WDW-315, do you have any reason to believe that the 45 feet of remaining sands in the lower Cockfield will have a permeability in excess of 1400 millidarcies once tested?

A It's unlikely in that the results of this core analysis do not provide any analysis showing that high a permeability value.



Q So I'll ask: Is it possible that those sands could be very clean sands, it could have a very high permeability, so that the average permeability of the entire injection interval would be 500 millidarcies?

A It is possible, but based upon the data here it's extremely unlikely.

Q Okay. Now, of course, the bottom line is -- is whether or not the 500-millidarcy assumption used by the applicant in their pressure modeling in their application is a -- a figure that is sufficiently conservative to be adequately protective of human health and the environment, and my question is do you believe that the 500-millidarcy figure is that conservative figure?

A No, I do not.

Q Okay. Let me take a step back. You ran two models on your own as part of your review of this application. Isn't that correct?

A That is correct.

Q Can you explain -- without going into a tremendous amount of detail -- can you explain the differences in the cones of influence, with respect to each model, meaning differences in feet from wellbore?

A The first -- or one of the models has a resultant cone of influence which is defined by a



pressure increase of 421 psi of approximately, I believe, 3170-a-foot radius from the injection well from 315.

The second one -- in which case the fault to the south is considered a no-flow boundary -- has a -- has a radius of the cone of influence directly to the north of something like 2.7 miles.

Q Well, let's -- do you have your prefiled testimony in front of you?

A I do.

Q Can you flip expediently to the pressure models that you conducted and let us know where you're looking with respect to prefiled testimony?

A In my prefiled testimony, Exhibits 12 and 13 have my two scenarios of pressure modeling. And 12 is a laterally-transmissive fault in which the cone of influence is -- all the way to the bottom of the table there -- it has a distance of 3170 feet from the injection well.

Q Okay.

A The second scenario in which the fault is considered a no-flow boundary has a cone of influence directly to the north of approximately 14,300 feet from the injection well. This cone of influence would necessarily be expanded a greater distance as one



moved laterally along the fault due to the fact that there would be no pressure dissipation south of the fault.

So although I did not calculate it, it would have a -- kind of a squashed moon shape and would be further out to the west and east along the fault line.

Q Based on -- and let's make the record clear -- the input values you used for these models were what with respect to permeability and thickness?

A I was trying to match the BOAST model as best I could and using only the difference of permeability as compared to the applicant's model, and issues of transmissivity or pressure boundary of the fault to the south -- the fault to the south acting as a no-flow boundary.

Q For the purposes of modeling in a Class I UIC application, based on your experience with putting these applications together, which do you believe, based on all the data that you have available to you in this application, to be the more conservative value with respect to the anticipated permeability of the injection reservoir proposed by TexCom, 500 millidarcies or 81 millidarcies?

A I believe 81 millidarcies is a more

conservative value.
Q And for purposes of that same modeling for the same type of application, which do you believe to be a more conservative value with respect to modeling, a -- considering the fault 4400 feet to the south of 315 to be laterally transmissive or laterally sealing?
A Laterally sealing.
Q Let me ask you again, Mr. Grant, whether or not you believe, if these draft permits were issued today, that TexCom would be required to conduct any of the perforations -- and certainly whether or not they would be required to subject any of that additional work to Fall-off testing -- and have all that work be subject to scrutiny of TCEQ before that well WDW-410 could be put into operation?
A No, I do not believe that those safeguards are in place as the permit is currently written -- as this draft permit is currently written.
MR. HILL: One second, Your Honor.
Q One last question, Mr. Grant. Can you please explain, in as simple terms as you can come up with, what type of Fall-off test would be required to allow us to know, with some degree of reliability, whether or not the fault to the south is laterally sealing?
A A Fall-off test under the either current or



additional perforated conditions should be run long enough so that any pressure boundary or no-flow boundary located to the south at the fault some 4400 feet away would show up in the data -- in the analysis of that data. And that can be calculated while -- prior to the test based upon an estimated permeability.
And it can be confirmed during the test before the test is over by doing analyses of the data as gathered to that point and looking for indications of boundaries or not. And determinations can be run as the Fall-off test is in progress from the data as gathered what your radius of investigation is. And a radius of investigation for the Fall-off test should extend beyond 4400 feet, not just to it, but some distance beyond it to confirm or disprove whether a no-flow boundary or some other kind of a barrier is present for that location.
Q And just as a quick follow-up, how much of more of an undertaking would that test be -- that particular breadth of a Fall-off test be -- how much more of an undertaking would that be over and above what you would normally be required to do under TCEQ rules as if this were a brand new well and you were constructing a Fall-off test for the purposes of a



completion report?
A Typically there is no preset distance that -- for a radius of investigation that one would have to run the Fall-off test for. So typically a Fall-off test would be run long enough until you got into a radial flow period and then the Fall-off test ended once you're in a radial flow period. This kind of a test would be extended out a time frame to necessarily reach a radius of investigation past the distance of the fault to the south.
MR. HILL: I have no further questions, Your Honor.
JUDGE EGAN: Okay. Mr. Walker?
MR. WALKER: No questions, Your Honor.
JUDGE EGAN: Mr. Forsberg?
MR. FORSBERG: I have no questions, Your Honor.
JUDGE EGAN: Ms. Collins?
MS. COLLINS: No questions.
JUDGE EGAN: Mr. Riley?
MR. RILEY: Just a few, and I'll try to be very quick.
JUDGE EGAN: That's okay.



RECROSS-EXAMINATION
BY MR. RILEY:
Q Mr. Grant, did anything that Mr. Hill asked you about change your opinion that with a Fall-off test demonstrating an average permeability of 500 millidarcies and a radius of investigation out beyond the fault would relieve your concerns regarding the review of this application?
A If those things -- what were the two things again?
Q Reperforation of the well, which we've been referring to interchangeably as WDW-315 and WDW-410, those are the same well, correct?
A Yes, that is correct.
Q So if that was reperforated as proposed in the TexCom application, and a Fall-off test was done that had a radius of investigation out beyond the fault to the southeast, the 4400-foot away fault -- say the radius of investigation went out 4600 feet, would it relieve any concern you have if it proved two things -- one, that the permeability was greater than 500 millidarcies and, two, that there was no boundary determined by the Fall-off test at 4400 feet?
A Yes, that would alleviate many of my concerns. What I would -- I would think would be

appropriate would be not -- since we don't the exact location of fault -- would not necessarily to take it an additional 200 feet past but, say, potentially a thousand feet past 4400 feet. And that would entail just running the fault injection period of the test in the Fall-off period longer.

Q And those -- that is achievable with the Fall-off test? In other words, that distance is something that can commonly -- or is commonly investigated by a Fall-off test. Is that correct?

A Yes, there's -- there are numerous Fall-off tests, depending upon the permeability, of course, and the thickness to where you would get distances out 8, 10,000 feet of investigation depending upon the length of the test.

Q All right. Let's go back just quickly now to the terminology used in redirect examination. There's something called the injection zone, correct? And that is the full interval as described in the TexCom application for the lower Cockfield, correct?

A No, the injection zone is the upper, middle and lower Cockfield.

Q Okay. But in terms of the sand, you're correct. I'm sorry. In terms of the sand that we're talking about, we're talking about the lower Cockfield



and its thickness in the area of WDW -- I'll use 310 --

A 315.

Q -- 315. I'm sorry. 315. It's approximately 345 feet. Is that correct?

A The gross thickness of the injection interval is approximately that, correct.

Q Now, when we talk about an injection interval and Mr. Hill asked you some questions about the hundred foot of sand that is currently perforated, we're talking about some portion of that hundred feet -- excuse me, of that 345 feet --

A That is correct.

Q And you indicated that's about 188 feet of that 345 feet, but it is netted for the actual -- for the actual perforation. In other words, within that 188 feet the current well is perforated in approximately 100 feet?

A It's perforated in approximately 100 feet of sand.

Q I'm sorry. Just to be clear -- I don't mean to cut you off. I apologize.

A I suppose there might be some perforations in shales. But as defined -- or as presented in the TexCom application, 100 feet of sand have been



perforated in that 188 feet interval.

Q Okay. So if I took -- again just for purposes of clarity -- 188 feet and the first 2 feet I perforate, that's 2, correct?

A Yeah, if it's in -- if we're counting towards the 100 feet, it would have to be 2 feet in a sand.

Q That's right. So I perforate 2 feet in a sand, then go down -- in other words, it's a cumulative total, and it totals to a net of 100 feet.

A Yes. And I don't know from the records whether it was -- I believe it was selective perforations across sands to come up with 100 feet. I don't believe the entire 188 feet, which includes many shales, was entirely -- that interval was perforated.

Q Okay. Is there a -- and I'm going to use terms that I only basically understand. Is there a number of shots-per-foot that is standard in the industry for a perforation?

A I'm not a petroleum engineer, but to my experience it is typically somewhere between 2 to 4 shots per foot, depending upon your perforating guns.

Q Okay. If the current well were perforated at 2 shots-per-foot and the intention is to perforate it at 4 slots per foot, would you agree that that could increase the permeability in the well, assuming



nothing else?

A No -- are you talking about reperforating a specific sand and then changing the permeability of that specific sand that's already been perforated?

Q I'm saying that within the foot -- interval of a foot it seems like there's a number of shots that are currently perforated. In other words, there are 2 shots-per-foot, I'm led to believe.

A I don't have a confirmation of that, but if you're saying it's 2 shots-per-foot, I'll assume that's the case.

Q Okay. And if it's increased to 4 shots-per-foot, would that change the results of a -- that fact alone, nothing else -- change the results of the Fall-off test? Do you know?

A I do not believe so. It will open more of that 1 foot of sand -- more holes into it and potentially, on a Fall-off test, decrease your skin. But there's no direct correlation to increasing your permeability since you're still looking at the same 1 foot sand whether it has 2 shots-per-foot in it or 4 shots-per-foot put in it.

Q Okay.

A Skin being, you know, friction pressure loss due to a fluid movement out of those perforations into

the -- into the formation sand.
Q Okay. Have you ever done a reperforation of a well increasing the number of shots-per-foot?
A My company has. I specifically do not go out on the well and do reperforations. But I have been involved in the preparation of reports after that has been done.
Q And in those instances you've not seen any difference in terms of permeability calculation?
A Not that I can recall.
Q Moving on, is the average permeability a function of a numeric average in terms of feet of sand? Because I thought when Mr. Hill was asking you questions you were correlating simply that hundred feet at a permeability of 81 millidarcies, and that if you added 45 feet to it, you calculated -- I think it was 1400 millidarcies would be necessary in order to bring the average up to 500 millidarcies. Is that an arithmetic average?
A It's a weighted arithmetic average. In other words, approximately 69 percent, which would be 100 over 145, has a permeability of 81 millidarcies as based upon the Fall-off test. If the remainder- 45 out of 145 feet, that's approximately 31 percent -- that is the unknown "X" and those two together, when



you take that weighted average, would have to equal 500 millidarcies.
Q But ultimately --
A So to recalculate back to what your "X" is, that weighted average -- or that average for the remaining 45 would have to be over 1400 millidarcies to make the entire 145 feet have a net permeability of 500 millidarcies.
Q Mr. Grant, wouldn't it actually be exactly opposite of your calculation? Wouldn't more fluid exit out the more permeable sand and, therefore, be inverse of what you just calculated?
A No, I don't believe so. In a Fall-off test, if you have the entire 145 feet over the period of the time of the Fall-off test, it would be 145 feet all take flow. You are getting a permeability value that's calculated off of that 145 feet. If only 20 feet of that take flow, your permeability value is going to be calculated off that 20 feet, but your flow capacity, which would go into your pressure model would have a much lower thickness at that point. It would have a higher permeability but a lower thickness since they're both in the denominator of the pressure increase calculation. It would probably be a wash.
Q Well, then --



JUDGE EGAN: Mr. Riley, I just have a quick question. Do you have many more questions? Because we have to adjourn at 6:00.
MR. RILEY: We could break now and just pick up here. I probably have 10 more minutes, but I'm not --
WITNESS GRANT: I'd rather finish up, if possible.
JUDGE WALSTON: If we can get it in about 10 minutes, but I do need to leave shortly.
MR. RILEY: I understand.
JUDGE EGAN: Okay.
Q (By Mr. Riley) Let me see if I understand. Is there any book or paper I could look to to verify your method of calculation in a weighted average context to understand how you came up with your 1400 millidarcie calculation?
A It's just a simple calculation of weighted averages, and I believe I have several textbooks that present that methodology.
Q Okay. The methodology, as I understand it, is you take the least -- or less permeable sand and you say that's 69 percent of the -- of the perforated interval, correct?
A Yeah. Maybe it's simpler to just break it in



thirds. In other words, you have to say you assume 150 feet total, and two-thirds of that -- that means 50 feet and 50 feet have 81 millidarcies, and that third third is unknown. But the three of those added up together and divided by 3 would need to equal 500 millidarcies.
Q Okay. But again, if I'm following along, if I had an 800 millidarcy permeability in a sand layer that I used -- or wouldn't that be the preferential pathway under pressure for fluid? So wouldn't most of the fluid in this Fall-off test exit into the more permeable sand?
A Yes, it would. An initial part of the Fall-off test, until it starts to build up pressure, and then it will start to flow into other sands that haven't pressured up or that have slightly lower permeability but now are accepting flow.
So it's hard to make a judgment as to that 20-foot or whatever it is with a very high permeability taking the flow over the entire injection period. It is much more likely that the -- that in a virgin reservoir such as this that over the period of the Fall-off or the injection period that all the sands will take flow and an average will be gathered, which relates to the true average of that reservoir in

the long-term to take fluid.
Q All right. I understand your position, and let me see one more time, just for absolute clarity, all of this would be verified by a Fall-off test post permit if you had -- if there was a condition that required it, correct? And that would answer the question, whether it be your method of calculation or Mr. Casey's method of calculation, it would be addressed in a Fall-off test?
A You mean calculation related to the permeability?
Q Yes, and as we talked about the radius of investigation of the fault to the --
A And the determination of a no-flow boundary to the south, those numbers would essentially be determined.
MR. RILEY: Thank you. No further questions.
JUDGE EGAN: All right. Mr. Williams?
MR. WILLIAMS: I have three short -- I hope -- questions, and if I can get short answers.
JUDGE EGAN: If you could speak up loudly though because we've got sirens going behind us.
MR. WILLIAMS: Right.



RECROSS-EXAMINATION
BY MR. WILLIAMS:
Q Mr. Grant, you testified about an instance where your client reperforated one of their wells?
A That is correct.
Q And there was no significant change in the Fall-off test. Is that correct?
A We're talking about where they reperforated the same sands they had already perforated?
Q Well, that's -- tell me. Why did they reperforate?
A They reperforated to get more holes per foot within the sands that they had already perforated. And it did not change to any substantial degree -- meaning within 5 to 10 millidarcies what the resultant permeability as calculated was.
Q Then why did they do it?
A Because they were having problems with skin issues related to the current perforations that they had and somewhat plugging of the -- of those perforations.
Q Okay. You mentioned that the -- a test that would detect the 4400-foot boundary, whether it would be transmissive or no-flow boundary, plus a thousand feet beyond it needed to be long enough. How long,



approximately?
A Well, the -- would have to be calculated based upon a formula or constant -- or monitoring the data as it's gathered during the injection period. But there are certain basic formulas you can use using worst-case permeabilities as to what the radius of influence would be. And so that would have to be calculated, but my guess is it would be anywhere from 24 to potentially 72 hours of injection.
Q The Fall-off test that was conducted on Well 315, do you remember how long it was run?
A I believe it was run for 12 hours at a certain rate -- I think 3 barrels-a-minute -- which is 120-some gallons-per-minute.
Q And didn't you express some concern -- a little bit of concern in your deposition that it was possibly not run long enough but it was run long enough for you to accept the values. Is that correct?
A Yes, it was run long enough to get into radial flow to determine what the permeability of the reservoir within 1500 feet was. I just, as a rule of thumb, like to run injection periods on the -- on the Fall-off testing a minimum of 24 hours just for my own purposes.
MR. WILLIAMS: No further questions.



Pass.
JUDGE EGAN: All right. Any redirect?
MR. HILL: No further questions, Your Honor.
JUDGE EGAN: All right. You have no questions -- then you're excused. Thank you very much.
WITNESS GRANT: Thank you.
JUDGE EGAN: Tomorrow morning -- I'm getting lost on where we're at. Is Lone Star --
MR. HILL: We have no more witnesses, Your Honor.
JUDGE EGAN: And do you have any more witnesses? You're finished, Mr. Walker?
Mr. Forsberg -- I think we're just down to staff. Is that correct?
MR. FORSBERG: I may have a couple of just little clean-up issues, but no witnesses.
JUDGE EGAN: All right. So we'll begin tomorrow morning with the staff's witnesses, other than some clean-up right in the beginning.
MR. RILEY: And I know Judge Walston needs to go, but just quickly what I anticipate right now is a very brief rebuttal. I would be surprised if it lasts more than two or three hours. And that

really largely depends on cross-examination.
As we talked about, I will attempt to file the direct of the rebuttal as prefiled rebuttal. I don't have it together now, so I can't offer it probably more than a couple of hours before I actually finish it.
JUDGE EGAN: Okay. Then we're adjourned until tomorrow morning at nine o'clock.
(Proceedings recessed at 6:01 p.m.)

**G**

**J**